Jnl Publ. Pol., **30**, 2, 201–218
doi:10.1017/S0143814X10000073
© Cambridge University Press, 2010

Performance and Risks in the Defense Procurement Sector

JEAN-MICHEL OUDOT *Economist, French Ministry of Defence*

ABSTRACT

Risks that emerge during the implementation and enforcement stages of defense procurement help explain procurement outcomes. Adverse events have impacts on the timing, cost and quality of goods supplied. The procurement process is analyzed on the basis of an original dataset covering 48 defense procurement contracts signed by the French Ministry of Defense with 18 European contractors. Contractual problems create the most adverse events in this sector, while technological risk is the second most significant risk. Although opportunism takes various forms, it is found only rarely in these defense contracts.

Key words: *Performance, risk assessment, defense procurement, transaction cost economics, opportunism*

Defense procurement is the mechanism through which the government acquires military equipment for national defense – warships, helicopters, aircraft fighters, missiles, electronic systems, tanks and the like. This process is governed by procurement contracts signed by the department of defense and contractors. The purpose of this article is to identify and assess the risks that occur during the implementation and enforcement of defense procurement contracts. What events prevent the objectives pursued in procurement contracts from being reached? What impacts do these events have on the performance of contracts in terms of timing, cost and/or quality?

From a theoretical perspective, this article explores the insights of transaction cost economics. According to this approach uncertainty is one of four variables characterizing a transaction, along with asset specificity, frequency and complexity (Argyres and Mayer 2007). It is assumed that parties *may* behave opportunistically, *i.e.* pursuing self-interest with guile (Williamson 1993). In this article I find that opportunistic behaviors rarely occur in the defense procurement sector. This finding confirms several analyses of other sectors (Coase 2000, 2006; Lafontaine and Masten 2002; Helper et al. 2000; Miwa and Ramseyer 2000) and contributes to document the debate on the relevance of this behavioral assumption in transaction cost economics.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

In practical terms, identifying difficulties faced during the implementation of procurement contracts may be useful in assessing the key contractual or organizational issues that need to be addressed. Thus, this article contributes to the literature dealing with the important governance issues arising from the contractual or organizational management of risks (see also Bergemann and Välimäki 2002; Binderkrantz and Christensen 2009; McAfee 1993; Myerson 1989; Roth 2002; Ryall and Sampson 2008; Sadeh, Dvir and Shenhar 2000). From a managerial perspective, this article emphasizes the main determinants of poor performance. In particular, I find that the most significant risk in the defense sector is contractual rather than technological, which contrasts with other literature in the field. The statistical results are also useful in assessing the scale of defense department contingency provisions (to cover price-overruns) and in understanding contractors' approaches to their risk portfolios (which reduces information asymmetry between parties).

These developments are documented through an original dataset compiled from 48 outsourcing procurement contracts signed by the French Department of Defense and 18 European contractors. The dataset covers many a range of highly technology-based defense equipment (including planes, warships, missiles, vehicles, communication systems) and includes all possible types of activities (research, production, maintenance, global). The average initial price of these contracts is €134.7 million. I refer to medium term contracts for the most part signed in 2002 and that, on average, came to an end in 2007. The paper falls into four sections. The first section is devoted to theoretical debates on risks and the second sets out the methodology used in this survey. The third section details the results of the analysis while the conclusion discusses the findings and their implications.

Theoretical debates surrounding risks

Risks are adverse events[1] characterized by a source, an impact and a probability of occurrence. While sources and impacts are detailed below, let us focus here on the probability. Whereas some scholars regard that a probability of occurrence can be associated to any adverse events, others think the opposite. Thus, Knight (1921: 19–20) deals with the concept of risk (to which a probability can be attributed), whereas Keynes (1936: 113–4) thinks that it is not possible to determine a probability to an event, and uses the concept of uncertainty. Thus, the difference between risk and uncertainty relies on the concept of probability (Chavas 2004: 6).

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

From a transaction cost economics perspective, as soon as adverse events are anticipated, contractual, organisational and/or institutional safeguards are searched to reduce their impacts, which induces transaction costs. If adverse events are not anticipated, then analysts are only subject to costs when they materialize. So, whatever the concept of probability selected, adverse events cause costs that have to be assessed in evaluating performance. Thus, adverse events take the form 0/1 in this article, depending on whether they took place or not, and whether they have been anticipated or not.

In the literature, much has been written on the type of risks that may occur during the implementation and enforcement of agreements in the defense sector (for a survey of the earlier work in the field see Williamson 1967). These studies focus on specific matters such as the information needed to manage a project (GAO 04-393; 06-257T; 06-368), failures in incentives (GAO 06-66), the competence of staff in the department of defense (GAO 06-110; Kasunic 2004), financial and book-keeping procedures (*Cour des Comptes* 1997 and 1999), changes in the demands of the military (French Department of Defense 2005, 2006), external shocks (Thomas 1999) or technological issues (Marschak et al. 1967; Peck and Scherer 1962; Sadeh, Dvir and Shenhar 2000).

For an overview of the situation in the risks in the defense sector, I assess all types of risks simultaneously (technological, contractual, industrial and direct financial). Thus, to explain contract performance, I can compare, for example, the relative importance of technological events and contractual and industrial events. In assessing impacts of risks, previous analyses focused on cost and/or time (GAO 06-368; 06-666), or cost and technical quality (Marschak et al. 1967; Peck and Scherer 1962). Here, I assess simultaneously the different impacts of risks (in terms of time, cost and technical quality) to identify trade-offs that occur during the implementation of defense procurement contracts.

Risk and opportunism in contractual relationships have attracted much interest in the literature. Opportunism is broadly defined as pursuing self-interest through guile (Williamson 1993) and as a deliberate breach of either the letter or the spirit of the contract (Klein 1996). It includes adverse selection and moral hazard (see Williamson 1993). Opportunism has been mainly illustrated by the Fisher Body – General Motors case in the 1920s (Klein 1991, 1996). The argument is that parties have a strong incentive to be opportunistic, a challenge each tries to limit by designing adequate *ex ante* safeguards, by following effective conflict resolution mechanisms, or by integrating (Williamson 1993; Klein 1996). However, the assumption that opportunistic behavior plays such a key role has been contested in the literature. Coase (2000; 2006), Casadesus-Masanell and Spulber (2000), and Freeland

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

(2000) have contested this interpretation. Other studies concur: opportunism does not seem to play a central role in the Japanese automobile industry (Miwa and Ramseyer 2000), the American automobile industry (Helper, MacDuffie and Sabel 2000) or in the US trucking industry (Lafontaine and Masten 2002). This article identifies the types of opportunism and assesses their frequency and impact in defense procurement.

Data and methods

The data set used in this study is composed of 48 outsourcing procurement contracts signed by the *Direction Générale de l'Armement*[2] (henceforth DGA) and 18 European contractors. These 48 contracts were written in support of 47 major weapons programs (two contracts were on the same program). While I cannot guarantee that the sample of programs and contracts is fully representative of the defense procurement process – I was not given access to *all* French defense contracts – the sample does not select on the key dependent variables of cost overruns and risk or cost sharing between the government and the firms.

All the contracts in the dataset are related to armaments production, and each military service is represented. The projects also vary substantially in complexity, ranging from the development of brand-new hardware to upgrades of older platforms. I was given unprecedented access to this data set in part because DGA was interested in learning more about the performance of contracts. I have no reason to believe it anticipated what the results of this study would be. I should also note that the GAO and UK National Audit Office (NAO) also rely on relatively small samples of defense contracts in conducting their published research on weapons costs, and I have no evidence that their selection is any more or less representative than is mine. Statistics on this dataset are detailed in the following Table.

Contracts included in the dataset were signed between 1994 and 2005 (2002 on average) with termination dates that are spread out

Table 1. Descriptive statistics for the dataset

	Nb of obs.	Average	Standard deviation	Min.	Max.
Year of signature	48	2002	2.3	1994	2005
Year of termination	48	2007	2.5	2000	2013
Initial price (€ million)	48	134.7	446.6	0.2	3000

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

between 2000 and 2013 (2007 on average)[3]. The mean duration of contracts is 5.1 years, which means that I deal with medium-term contracts. The average value of these contracts is €134.7 million, ranging from €0.2 million to €3 billion (current prices). The high value of the standard deviation of prices suggests that prices are diverse in the dataset, reflecting the range of DGA contracts.

Contracts included in the database were awarded through competitive tendering in 23 per cent of cases, while 23 per cent of contracts were awarded following a mixed process of negotiation and competition. Furthermore, 54 per cent of contracts have been awarded through negotiation without competition (26 observations). The predominance of negotiation in the defense procurement sector is mainly explained by the need to have an independent procurement process regarding foreign contractors so that defense procurement decisions are aligned with foreign policy decisions.

While few contracts in the dataset are focused on the research and technology activity (1 observation or 2 per cent), 34 per cent of contracts include both research and production (16 observations). 27 per cent of cases involved a global contract covering research, production and maintenance (13 observations). Thus, all time phases of defense procurement contracts are included in the dataset analyzed (research, production and maintenance), with single or multiple purposes.

I developed a questionnaire to assess the risks that took place during the implementation and enforcement of contracts. The central goal of this questionnaire was to assess and explain the overall performance of contracts and also to understand the logic underlying the implementation of these contractual arrangements. The questionnaire included 364 different items. The data collected could be grouped into two broad areas. First, I collected information about the co-operation or non-co-operation of the different contractors involved, co-operation of different buyers where relevant, the types of activities at stake (research, production, maintenance, global), the type of equipment involved (e.g. planes, missiles, vehicles), and overall performance (approximated through cost-overruns, that is, the ratio of final costs to costs initially estimated; through delays and through quality decreasing). Second, for each risk that occurred after the contract was agreed upon, the questionnaire collected views on the expected probability of risk at the outset, the sources of risks actually experienced, the source of risks considered as the most significant in explaining risks occurrences, and the impact of risks on costs, quality, and completion times.

With the help of 13 defense contractors as well as the DGA, I was able to classify risks under four main headings, structured according to the source of adverse events[4]. First, as expected, are technological risks,

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

referring to all technical or technological-related events with a significant impact on contract performance. Reaching technical state-of-the-art thresholds is included into the technological risk for instance. Second I identified contractual risks, which are related to the characteristics of the contract *per se*, that is, its negotiation, drafting, notification and the conditions of its enforcement. Typically, opportunism is found in this category. Third, there are industrial risks, such as when contractors or subcontractors are unable to meet their commitments, for instance, because they overestimated their capacities. Fourth, I identify direct financial risks, defined as events that directly modify the initial equilibrium between revenues and expenses, either because revenues were below expected levels or were late coming in, or because costs seriously exceeded initial estimates.

Before drafting the questionnaire, I conducted 80 interviews with contractors and DGA executives in order to understand the details of the procurement contracts and list all risks that might occur during the enforcement period. The questionnaire was sent to the DGA and completed by managers responsible for contracts, *i.e.* by the staff whose knowledge on contracts is the most precise and relevant. The answers covered 51 contracts. Every answer was systematically double-checked by a qualitative analysis of replies and extensive telephone interviews with respondents to be sure their answers corresponded to reality. In addition, I had access to formal procurement contracts (both initial agreements and their amendments), which was used as third source of information. At the end of this process, information was triangulated through an analysis of formal contracts, questionnaires and interviews with program managers and executives. Among the 51 responses, 3 answers were rejected due to validity or reliability issues[5]. The final database therefore contained information on 48 contracts.

Performance Of Contracts

Explaining different dimensions of performance

Financial performance refers to gaps between anticipated costs, estimated at the start of the project, and actual costs. From a financial perspective, a contract performs when the latter equals the former, *i.e.* when there are no cost-overruns. Cost-overruns were experienced in 87 per cent of contracts analyzed (42 observations). The mean cost-overrun was assessed at € 6.03 million per contract. This represents an average of 10.0 per cent of the initial contract prices, with a standard deviation of 10.4. The maximum cost-overrun observed in the dataset represents 45.7 per cent of the initial price of the contract.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

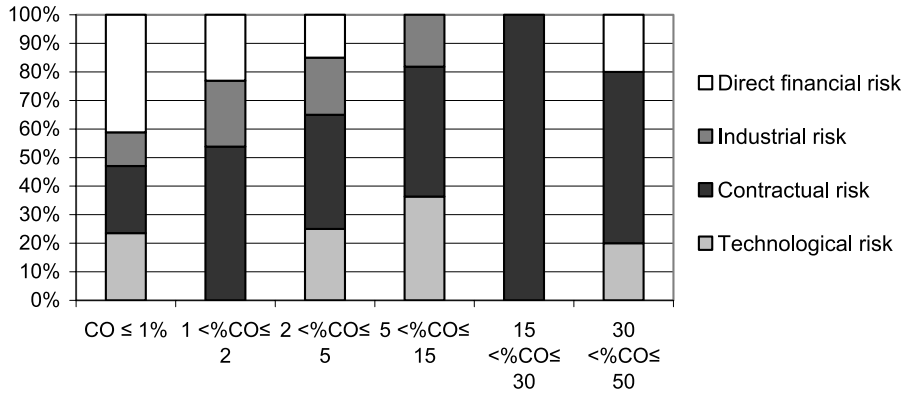

FIGURE 1 *Impacts of risks on cost-overruns*

Figure 1 details the impact of the different risks on cost-overruns that occurred during the implementation of the contracts. I differentiate cost-overruns according to their importance as defined by their size in relation to initial estimated costs. The six columns of figure 1 distinguish between the causes of overruns for six different magnitudes of overrun (below 1 per cent of initial estimated cost, between 1 and 2 per cent, 2 and 5 per cent, 5 and 15 per cent, 15 and 30 per cent, 30 to 50 per cent). While technological risk accounts for 24 per cent of the smallest category of cost-overruns (below 1 per cent of initial prices), contractual risk explains 24 per cent, industrial risk 12 per cent and direct financial risk 41 per cent. Yet Figure 1 shows that contractual risk turns out to be the most significant risk in all cost-overrun categories except the very smallest. In particular, the emergence of adverse contractual events account for 54 per cent of excess costs in contracts coming in between 1 and 2 per cent above initial prices; 100 per cent of cost-overruns in the 15 to 30 per cent category; and 60 per cent in the 30–50 per cent category. Technological risk comes second, followed by the industrial risk and the direct financial risk.

Schedule performance refers to differences between expected timescales (at the start of the project) and actual delivery. A contract performs when there are no delays. In the dataset delays were observed in 92 per cent of contracts (44 observations). The average delay was 10.5 months and the mean duration of contracts was 54 months, ranging from 10 to 132 months. Thus, delays represented an average of 24 per cent of initial expected duration, which adds an extra 2 months to every year a contract was supposed to run. The longest delay extended the contract by 133 per cent. Schedule performance is explained in figure 2 showing the relative impact of different risks on delay during the

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

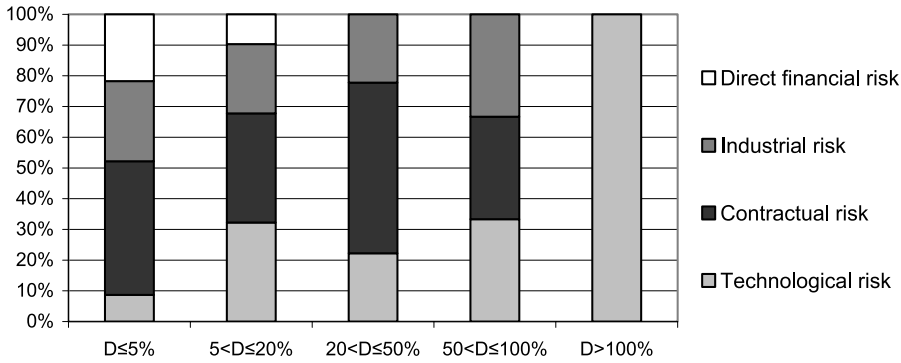

FIGURE 2 *Impacts of risks on delays*

implementation of contracts. Delays are analyzed in five different scales according to their duration (less than 5 per cent of the planned duration of the contract, between 5 and 20 per cent, between 20 and 50 per cent, between 50 and 100 per cent and over 100 per cent).

Technological risk explains 100 per cent of over 100 per cent of expected duration (last column of figure 2). However, this column contains only one observation. If it is excluded, then contractual risk becomes the most significant risk in explaining delays. Indeed, adverse contractual events explain 43 per cent of the shorter duration delays (below 5 per cent over initial estimated length), 35 per cent of delays belonging in 5 to 20 per cent category, and 56 per cent of delays in the 20 to 50 per cent category. Other risks have less significant impacts. As in the previous section, contractual risk turns out to be the most significant risk in the explanation of the schedule performance, followed by technological risk, industrial risk and direct financial risk.

Technical performance refers to gaps between the quality specified in contracts and the final quality delivered. A contract performs when the latter equals the former, *i.e.* when there is no technological gap. Technical performance is measured using a Likert scale, where 1 means no gap, 2 a rather small gap, 3 an average gap, 4 a rather large gap and 5 a large gap. 73 per cent of contracts (35 observations) had no gap between expected quality and the specifications delivered by contractors. When such a gap exists, differences between expectations and final quality delivered are regarded as rather low in 17 per cent of cases, average in 8 per cent of cases and rather high in only 2 per cent of cases. Thus, adverse events that occur during the implementation and enforcement of contracts have a very low impact on technical performance.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

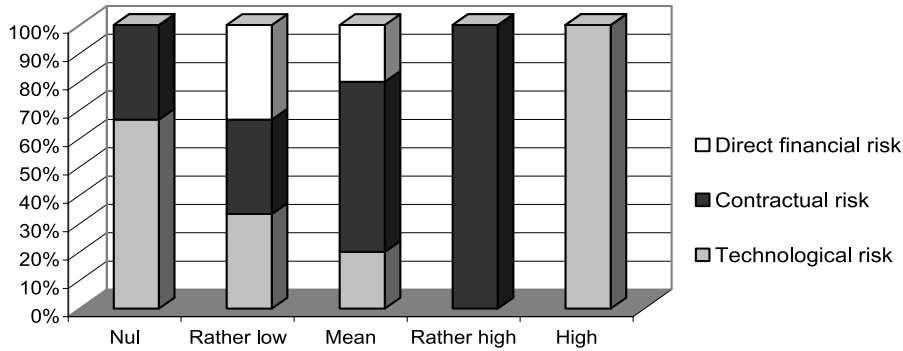

FIGURE 3 *Impacts of risks on technical performance*

Figure 3 presents the risks affecting *technical performance* according to five scales of effect: where they were perceived by DGA officials to have had no effect (category 1), or where the effects were low (category 2), medium (category 3), quite high (category 4) or high (category 5). While technological risk explains 100 per cent of shortfalls in technical performance where such shortfalls are viewed as having high impact (category 5), contractual risk explains 100 per cent of reductions in technical performance whose importance is viewed as quite high (category 4). If we exclude these observations (they refer to only one observation each), then it turns out that contractual risk is the most important risk in explaining shortfalls in technical performance. Technological, direct financial and industrial risks are ranked below contractual risk. Since contractual risk appears to be the most critical risk in the French defense procurement sector, the next section is devoted to its analysis.

Contractual risks

Contractual risk emerged 35 times in the 48 contracts analyzed (73 per cent). The data can be used to differentiate stages of the contract's life during which adverse contractual events occur. While difficulties related to the selection of contractor(s) or sub-contractors occurred in 9 contracts of the dataset (19 per cent), problems in negotiating and writing contracts occurred 20 times (42 per cent). Contract notification was delayed in 6 contracts (12 per cent). These *ex ante* adverse contractual events can be distinguished from those, which are *ex post*. *Ex-post* events are more frequent than *ex ante* events. Indeed, contractual events occurring after the contract cause adverse effects on performance in 34 cases in the dataset (71 per cent). These events are

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

predominant in explaining contractual risk. This finding confirms the relevance of the transaction cost economics approach with its focus on both pre-and post-contract periods to account for performance (Bajari et al. 2006; Williamson 1996).

Selection of contractors and sub-contractors

Contractual difficulties relating to the selection of contractors (7 observations) and/or sub-contractors (6 observations) are caused by choosing contractors and/or subcontractors unable to complete the objectives pursued in the contract. Poor choice of contractors by the DGA results from contractors' opportunism in 86 per cent of cases (6 observations out of 7)[6], when contractors declared they would be able to complete the contract within the specified time and cost although they knew that they would not be able to do so. Here the contractor anticipated post-contractual renegotiation with the DGA even though the initial selection process may have been competitive (in the dataset, 23 per cent of contracts were awarded through competitive tendering and 23 per cent with both negotiation and competition). The switch from *ex ante* competition to post contractual bilateral bargaining is explained by idiosyncratic investments (Williamson 1985). Pretending to be able to complete the financial, schedule and/or technical objectives while being aware of their inability to do so is called 'buying-in' (Bower and Osband 1991, p. 108; Kovacic 1991, p. 222) or winner's curse (Bulow and Klemperer 2002; Hong and Shum 2002). Such opportunistic behavior was observed in 12 per cent of contracts analyzed.

Moreover, poor choice of sub-contractor is explained in 83 per cent of cases by subcontracting decisions (5 observations out of 6)[7]. The main contractor selected firms that later proved unable to fulfill the contract as planned. A sub-contractor's buying-in behavior, industrial joint-ventures between contractors and sub-contractors, the lack of capacity (especially as regards capital and human resource assets) within the relevant market can explain poor choice of sub-contractors.

Negotiation and writing contracts

42 per cent of contracts have been affected by adverse contractual events during the negotiation and writing of contracts (20 observations). These events concern poor construction of contractual clauses and are divided into two groups. The first group covers incomplete contracts. Both the technical specifications (14 observations) and the rules/processes of equipment approval (5 observations) turned out to be

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

incomplete in the contracts analyzed. Partners exploited this contractual incompleteness by resorting to opportunistic behavior during the implementation of contracts.

The second group of determinants of contractual risks, those occurring as contracts are negotiated and written, reveals opportunistic behavior. Contractors deliberately underestimated delays, costs and technical difficulties in 6 contracts, at a time when the DGA still had the opportunity to contract with another firm. Again, the buying-in concept can be suggested as an explanatory factor for this kind of behavior. Moreover, the DGA engaged in opportunistic behavior in two contracts by demanding *ex ante* specific contractual clauses (delays and intellectual property clauses in particular) that were revealed as afterwards to be irrelevant.

Notification of contracts

The notification of contracts is the process through which public bodies (the representatives of external financial monitoring institutions and the Department of Defense) officially validate contractual choices once the contractor has signed the contract. Notifications were delayed in 6 contracts (*i.e.* in 12 per cent of cases). These delays were caused by budget difficulties (6 observations) and/or regulation issues (2 observations). Responsibility for budget difficulties fell to the Department of Finance in 50 per cent of cases, and also the DGA and the Military. In contrast to the implementation of contracts, no opportunism was observed at this stage in the contract life cycle.

Implementation of contracts

During the implementation of contracts, adverse contractual events occurred in 34 contracts, *i.e.* in 71 per cent of observations. We can distinguish opportunism from other adverse contractual events. These include the failure of government-supplied equipment[8] (22 observations; 46 per cent of contracts), subsequent changes to technical specifications (21 observations; 44 per cent of contracts) and changes to quantities ordered (6 observations; 12 per cent of contracts), difficulties related to interdependence with other contracts (12 observations; 25 per cent of contracts) and co-ordination issues between transaction partners (6 observations; 12 per cent of contracts). Opportunistic behavior also occurred during the implementation of contracts. On the one hand, contractors exploited the incompleteness of contracts on matters of timing and management (e.g. in monitoring, rendezvous clauses).

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

Contractors interpreted contracts in ways that fitted their own interests and not the spirit of the original contract in 5 contracts (10 per cent of observations).

On the other hand, the DGA also engaged in opportunistic behavior where contracts were incomplete by rejecting equipment supplied for reasons unrelated to procurement considerations: the DGA could not pay for them at that time (2 contracts; 4 per cent of observations). Interviews with contractors also revealed another form of opportunism by the DGA: unilateral decisions modifying the original terms after the contract had been signed. The DGA backed their demand that contractors agree to changed conditions with the threat of cancelling the contract altogether. This behavior results from the DGA's specific position (sole buyer) in a context of an administrative contract and is regarded as a *fait du prince* by contractors. Although opportunistic behavior takes various forms in the French defense procurement sector, its frequency is relatively low (about 10 per cent of contracts).

The ten most critical events in the defense procurement sector

Table 2 lists the 10 most critical events in French defense procurement sector as regards risk. This list serves a practical purpose since it points to the most significant events with an adverse effect on the contract performance. Procurement analysts can be directed towards ensuring these events are properly managed. This list is compiled by combining the ranking of the different risks by the DGA's respondents with the most critical events identified in each risk. In the survey, I asked the respondents to identify the event that best explains the occurrence of each risk considered, from all the events that could possibly explain the occurrence.

The most critical event in the defense procurement sector is the DGA's failure to meet its commitments as regards government-supplied equipment. Such equipment is either supplied late (21 observations), and/or with a different specification from what was expected (9 observations), and/or was not delivered at all (in 3 contracts). Contract performance also suffered significantly from changes in requirements after contracts had been signed. Changes in both quantities ordered (6 observations) and in technical specifications (21 observations) were noted. These changes are explained by both changes in the needs of the military over time (13 observations) and changes in how demand was assessed by the DGA[9] (10 observations). This result points to a degree of uncertainty when it comes to defining needs when

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

Table 2. The 10 most critical events in the defense procurement sector

Risk categories	Critical determinants of risk categories
Contractual	1 Failure in government-supplied equipment
	2 Post-contractual changes in requirements
	3 Issues arising from interdependence between contracts
Technological	4 Underestimation of the complexity of the equipment to be supplied
	5 Complexity of the equipment to be supplied
	6 Technical lack of capacity by sub-contractors
Industrial	7 Deficiencies in management capacity of contractors
	8 Deficiencies in management capacity of sub-contractors
Direct financial	9 Decision by military to cut funding
	10 Freezing of resources by military or DGA

procurement contracts are launched. The third most critical event is related to the interdependence between different contracts. Every contract is in principle independent from others, but contracts are often technically tied to other agreements. For instance, one piece of equipment is necessary to supply another. Thus, the defense procurement process can be characterized as a network organization. We should note that opportunism does not appear among the top ten risks in Table 2.

The other critical events in Table 2 are related to technological issues. The DGA respondents pointed out that the complexity of the equipment in question might be underestimated. As a result, the managers in the DGA and contracting firms do not allocate the correct human and technical resources to the project, and the project cannot be completed as initially planned. The complexity of the equipment to be procured is also a critical event as along with the lack of the sub-contractors' technical competence. Critical industrial determinants point to a lack of organizational abilities on the part of contractors and subcontractors, while direct critical financial determinants refer to cuts and freezes in military or DGA budgets.

Conclusion

The assessment of risks in French defense procurement shows that cost-overruns and delays are almost endemic to procurement contracts in defense, whereas technical performance does not really suffer from adverse events as contracts are implemented and enforced. Since parties to the contract decide not to reduce the technical capabilities of defense systems in the face of adverse events, but rather extend the contract and increase costs, technical objectives may be regarded as the

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

most important objective pursued in the implementation of defense procurement contracts. On the other hand, costs and delays can be regarded as adjustment variables in the face of adverse events. Thus, I recognize the same hierarchy of performance deviations found by Peck and Scherer (1962), where military leaders sacrifice cost and timing to achieve technical goals, but the explanation of poor performance offered here differs from previous studies.

Contractual risk turns out to be most significant in the French defense procurement sector. Whereas the defense procurement sector is usually presented as being dominated by technical issues (Kovacic 1991; Marschak et al. 1967; Peck and Scherer 1962, Sadeh, Dvir and Shenhar 2000), in my dataset contractual risks appear to be the most critical. As a matter of fact, adverse contractual events are the most significant variable in the explanation of cost-overruns, delays and reductions in technical performance. The effects of technological, industrial and direct financial risks are less important than those of contractual risk. Thus, while transaction partners seek to complete fundamental technical goals, contractual events offer the most significant explanation for shortfalls in the financial, schedule and technical performance of defense procurement contracts in France.

I suggest two explanations for this result. First, both scholars and managers regard the defense procurement process as being dominated by technical issues. Interviews with managers from the DGA and managers from 13 different French contractors clearly point out the technical orientation of efforts undertaken to prevent risks from materializing. As a result of these efforts, adverse technical events are effectively monitored and occur less frequently than initially anticipated. At the same time, managers clearly disregard adverse contractual events, and/or do not have the ability to analyze them. Accordingly, contractual risk occurs frequently and causes significant damage.

These findings are reminiscent of the crucial role played by contracts in the co-ordination of transaction partners (Binderkrantz and Christensen 2009; Carson et al. 2006; Das and Teng 1998; Masten 1993; Mayer and Argyres 2004; Sadeh, Dvir and Shenhar 2000). The contract co-ordinates the parties by stipulating the rights and duties of the parties to the transaction. In addition, according to the contractual choices selected, adaptation, incentives and administrative controls are modified (Williamson 1985 and 1991). Since these features are core determinants of co-ordination, coordination is directly influenced by contractual choices. Furthermore, procurement processes became increasingly complex with an increased number of transacting parties and sub-contractors, along with the specialization of industrial partners.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

This increasing complexity makes contractual commitments more damaging when they are not enforced as the contract is being implemented. That is why the co-ordination function of contracts helps to account for the significance of adverse contractual events in explaining performance, and why contractual risk is more significant now than in the 1950s and 1960s (as developed by Marschak et al. 1967; Peck and Scherer 1962 for instance).

Since contractual risk turns out to be the most significant risk in the defense sector, I expect further efforts to mitigate such events in the near future, fostering a new research agenda. The accurate analysis of contractual risks emphasizes the frequency of different types of opportunism in this sector. Buying-in behavior has attracted particular attention. Although opportunism may take various forms, its frequency is relatively low in defense procurement. This result confirms and completes previous analyses of other sectors that discuss the accuracy of this behavioral assumption in transaction cost economics (e.g. Coase 2006; Lafontaine and Masten 2002). A list of the ten most critical events in the French defense procurement sector does not include opportunism and emphasizes the role of government supplied equipment, interdependence between contracts, issues related to the ability of the military and the DGA to come to a settled view, complexity and also the lack of the different parties' organizational or technical abilities. This result justifies further analyses that might improve the performance of defense procurement contracts, with a special focus on contractual and organizational choices.

NOTES

1. Most analyses on risks focus on negative impacts (for instance Alberts and Dorofee 2005 p. 7, Dorofee et al. 1996 p. 20, Williams et al. 1999 p. 3, and Yates and Stone 1992), while very few ones take into account their positive impacts (March and Shapira 1987, Young and Tippins 2001).
2. The *Direction Générale de l'Armement* is responsible in France for the procurement of defense systems on the behalf of the government. Its British counterpart is called "Defence Equipment and Support" and the American one is represented by a few different organizations within the Department of Defense.
3. While most of the contracts analyzed are completed, some of them are still being implemented at this time. Contracts which are not terminated are either maintenance contracts, *i.e.* concern low-uncertain activities, or deal with equipment whose realization is very close to being completed. Thus, in every case analyzed, the knowledge regarding adverse events that occur during the implementation of contracts is relatively complete.
4. From a methodological point of view, the number of risks categories is expected to be minimized (to favor the assessment of their impacts) and be based on a single variable (so that every adverse event cannot be introduced in different categories). Three variables can be used in structuring categories of risks: the period at which events occur (useful in project management), impacts of events (cost-overruns, delays, reductions in quality) or according to sources of events. I have chosen the third possibility.
5. I rejected cases when responses to questionnaires were not consistent, or when the manager responsible for the contract declared that he does not have a definitive view on risks, because for instance the contract is not completed yet and some risks may still occur.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

6. The other reason why the choice of contractors was irrelevant is due to human factors within the DGA: lack of organization of human abilities (1 observation).
7. The other factor explaining the irrelevant choice of sub-contractors is based on opportunism on the part of the DGA: it imposed *ex ante* the selection of sub-contractors who were unable to complete the technical objectives *ex post* (1 observation).
8. Government supplied equipment includes defense equipment to retrofit, items for intermediary consumption, test facilities, infrastructures and carrier vehicles. The equipment is delivered by public authorities, most often the department of defense. Government supplied equipment can be regarded as specific assets that are introduced in the realization process of equipment to realize. In the dataset analyzed, 73 per cent of contracts (35 observations) planned to use government furnished equipment. In 22 contracts, their delivery did not respect the initial commitment; either there was a delay in delivery, and/or it was delivered with a different specification than initially planned, and/or it was not delivered at all. The failure rate of delivering equipment as initially planned is 63 per cent.
9. In the French defense procurement sector, the Military initially expresses what it needs. The DGA translates this operational need into technical specifications to be introduced into the original procurement contract. Changes in the demand come from these two determinants.

REFERENCES

Alberts C. J. and Dorofee A. J. (2005) Mission Assurance Analysis Protocol: Assessing Risk in Complex Environments. *Software Engineering Institute*, Carnegie Mellon University, http://www.sei.cmu.edu/pub/documents/05.reports/pdf/05tn032.pdf, accessed on March 11, 2010.

Argyres N. S. and Mayer K. J. (2007) Contract Design as a Firm Capability: An Integration of Learning and Transaction Cost Perspectives. *Academy of Management Review* 32(4): 1060–1077.

Bajari P., Houghton S. and Tadelis S. (2006) Bidding for Incomplete Contracts: An Empirical Analysis. *NBER working paper* n°12051.

Bergemann D. and Välimäki J. (2002) Information Acquisition and Efficient Mechanism Design. *Econometrica* 70(3): 1007–1033.

Binderkrantz A. S. and Christensen J. G. (2009) Governing Danish Agencies by Contract: From Negotiated Freedom to the Shadow of Hierarchy. *Journal of Public Policy* 29(1): 55–78.

Bower A. G. and Osband K. (1991) When More Is Less: Defense Profit Policy in a Competitive Environment. *Rand Journal of Economics* 22(1): 107–119.

Bulow J. and Klemperer P. (2002) Prices and the Winner's Curse. *Rand Journal of Economics* 33(1): 1–21.

Carson S. J., Anoop M. and Wu T. (2006) Uncertainty, Opportunism and Governance: The Effects of Volatility and Ambiguity on Formal and Relational Contracting. *Academy of Management Journal* 49(5): 1058–1077.

Casadesus-Masanell R. and Spulber D. F. (2000) The Fable of Fisher Body. *Journal of Law and Economics* 43(1): 67–104.

Chavas J.-P. (2004) *Risk Analysis in Theory and Practice*. Elsevier Academic Press, San Diego (CA).

Coase R. H. (2000) The Acquisition of Fisher Body by General Motors. *Journal of Law and Economics* 43 (1): 15–32.

Coase R. H. (2006) The Conduct of Economics: The Example of Fisher Body and General Motors. *Journal of Economics and Management Strategy* 15 (2): 255–278.

Cour des Comptes (1997) La gestion budgétaire et la programmation au ministère de la défense [budget management and programmation in the defense department], rapport public particulier, *Les Editions des Journaux Officiels*.

Cour des Comptes (1999) Rapport au Président de la République. *Les éditions des Journaux Officiels*.

Das T. K. and Teng B.-S. (1998) Between Trust and Control: Developing Confidence in Partner Cooperation in Alliances. *Academy of Management Review* 23(3): 491–512.

Dorofee A. J., Walker J. A., Alberts C. J., Higuera R. P., Murphy R. L. and Williams R. C. (1996) *Continuous Risk Management Guidebook*, Software Engineering Institute, Carnegie Mellon University.

Freeland R. (2000) Creating Hold-Up through Vertical Integration: Fisher Body Revisited. *Journal of Law and Economics* 43(1): 33–66.

French Department of Defense June 3 (2005) *Comité des Prix de Revient des fabrications d'Armement, vingt-septième rapport d'ensemble*. Journal Officiel de la République Française, Edition des documents administratifs.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

French Department of Defense May 10 (2006) *Comité des Prix de Revient des fabrications d'Armement, vingt-huitième rapport d'ensemble* [Comity for price assessment of military equipment, twenty-eighth general report]. Journal Officiel de la République Française, Edition des documents administratifs.

Government Accountability Office March (2004) *Defense Acquisitions. Stronger Management Practices Are Needed to Improve DOD's Software-Intensive Weapon Acquisitions*, report n°04-393.

Government Accountability Office November (2005) *DOD Acquisition Outcomes. The Case for Change*, report n°06-257T.

Government Accountability Office November (2005) *Best Practices. Better Support of Weapon System Program Managers Needed to Improve Outcomes*, report n°06-110.

Government Accountability Office December (2005) *Defense Acquisitions. DOD Has Paid Billions in Award and Incentive Fees Regardless of Acquisition Outcomes*, report n°06-66.

Government Accountability Office April (2006) *Defense Acquisitions. Major Weapon Systems Continue to experience Cost and Schedule Problems under DOD's Revised Policy*, report n°06-368.

Government Accountability Office July (2006) *Defense Acquisitions. Further Management and Oversight Changes Needed for Efforts to Modernize Cheyenne Mountain Attack Warning Systems*, report n°06-666.

Helper S., MacDuffie J. P. and Sabel C. (2000) Pragmatic Collaborations: Advancing Knowledge While Controlling Opportunism. *Industrial and Corporate Change* 9(3): 443–488.

Hong H. and Shum M. (2002) Increasing Competition and the Winner's Curse: Evidence from Procurement. *Review of Economic Studies* 69(4): 871–898.

Kasunic M. (2004) *Army Strategic Software Improvement Program (ASSIP). Survey of Army Acquisition Program Management. Results of the 2003 Survey of Army Acquisition Managers*, Software Engineering Institute, Carnegie Mellon University.

Keynes J. M. (1936) *The General Theory of Employment, Interest and Money*, MacMillan Cambridge University Press.

Klein B. (1991) Vertical Integration as Organizational Ownership: The Fisher Body – General Motors Relationship Revisited. In *The Nature of the Firm: Origins, Evolution and Development*, edited by Williamson Oliver E. and Sydney Winter 213–226. New-York, Oxford University Press.

Klein B. (1996) Why Hold-ups Occur: The Self-Enforcing Range of Contractual Relationships. *Economic Inquiry* 34: 444–463.

Klein B. (2000) Fisher-General Motors and the Nature of the Firm. *Journal of Law and Economics* 43(1): 105–141.

Knight F. H. (1921) *Risk, Uncertainty and Profit*, University of Chicago Press.

Kovacic W. E. (1991) Commitment in Regulation: Defense Contracting and Extensions to Price Caps. *Journal of Regulatory Economics* 3(3): 219–240.

Lafontaine F. and Masten S. E. (2002) Contracting in the Absence of Specific Investments and Moral Hazard: Understanding Carrier-Driver Relations in US Trucking. *NBER* Working Paper n°8859.

McAfee R. P. (1993) Mechanism Design by Competing Sellers. *Econometrica* 61(6): 1281–1312.

March J. G. and Shapira Z. (1987) Managerial Perspectives on Risk and Risk Taking. *Management Science* 33(11): 1404–1418.

Marschak T., Glennan T. K. Jr. and Summers R. (1967) *Strategy for R&D. Studies in the Microeconomics of Development*. New-York: Springer-Verlag.

Masten S. E. (1993) Transaction Costs, Mistakes and Performance: Assessing the Importance of Governance. *Managerial and Decision Economics* 14(2): 119–129.

Mayer K. J. and Argyres N. (2004) Learning to Contract: Evidence from the Personal Computer Industry. *Organization Science* 15(4): 394–410.

Miwa Y. and Ramseyer J. M. (2000) Rethinking Relationship-Specific Investments: Subcontracting in the Japanese Automobile Industry. *Michigan Law Review* 98: 2636–2667.

Myerson R. (1989) Mechanism Design by Competing Sellers. In *Allocation, Information and Markets*, edited by Eatwell John, Milgate Murray and Peter Newman. New-York: W.W. Norton & Co.

Peck M. J. and Scherer F. M. (1962) *The Weapons Acquisition Process: An Economic Analysis*. Harvard: Harvard University.

Roth A. E. (2002) The Economist as Engineer: Game Theory, Experimental and Computation as Tools for Design Economics. *Econometrica* 70(4): 1341–1378.

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press

Ryall M. D. and Sampson R. C. (2008) Formal Contracts in the Presence of Relational Enforcement Mechanisms: Evidence from Technology Development Projects. *University of Maryland* working paper.
Sadeh A., Dov D. and Shenhar A. (2000) The Role of Contract Type in the Success of R&D Defense Projects Under Increasing Uncertainty. *Project Management Journal* 31(3): 14–22.
Thomas G. B. (1999) External Shocks, Conflict and Learning as Interactive Sources of Change in U.S. Security Policy. *Journal of Public Policy* 19(2): 209–231.
Williams R. C., Pandelios G. J. and Behrens S. G. (1999) Software Risk Evaluation. Method Description, Version 2.0. *Software Engineering Institute*, Carnegie Mellon University, http://www.sei.cmu.edu/reports/99tr029.pdf, accessed on March 11, 2010.
Williamson O. E. (1967) The Economics of Defense Contracting: Incentives and Performance. In McKean (ed.) *Issues in Defense Economics*, Columbia University Press, New-York: 217–256.
Williamson O. E. (1985) *The Economic Institutions of Capitalism. Firms, Markets, Relational Contracting*. New-York: The Free Press.
Williamson O. E. (1991) Comparative Economic Organization – The Analysis of discrete Structural Alternatives. *Administrative Science Quarterly* 36(2): 269–296.
Williamson O. E. (1993) Opportunism and Its Critics. *Managerial and Decision Economics* 14(2): 97–107.
Williamson O. E. (1996) *The Mechanisms of Governance*. Oxford: Oxford university Press.
Yates J. F. and Stone E. R. (1992) *Risk Taking Behavior*. Wiley, Chichester.
Young P. C. and Tippins S. C. (2001) Managing Business Risk. An Organisation-Wide Approach to Risk Management. *American Management Association*, New-York.

JEAN-MICHEL OUDOT
Economist
French Ministry of Defence
Ministère de la défense
Direction des affaires financières / QEFI
14, rue Saint-Dominique
75700 Paris SP07
France
Phone: +33 6 74 67 17 21; Fax: +33 1 42 19 42 15
e-mail: oudot@univ-paris1.fr

https://doi.org/10.1017/S0143814X10000073 Published online by Cambridge University Press