

**PERFORMANCE ASSESSMENT OF DEFENSE PROCUREMENT CONTRACTS:
WHAT INDICATORS?**

Jean-Michel OUDOT

Centre ATOM, University of Paris I Panthéon – Sorbonne
106-112 boulevard de l'Hôpital
75647 Paris cedex 13 - France
oudot@univ-paris1.fr

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Abstract

This article addresses a methodological issue: What performance indicators can be used in the defense procurement sector to appreciate the governance structure choices? I posit the developments within the transaction cost framework. An extension of the usual transaction characterization to the determinants of the transaction objectives is suggested. Such an extension is likely to favor the justification of the performance indicators. A list of these indicators is presented in the defense procurement sector.

INTRODUCTION

This article deals with one issue related to the methodology of the performance assessment of defense procurement contracts¹: What performance indicators can be used? Here, a performing contract is regarded as a transaction in which the partners reach their objectives (including both efficiency and efficacy dimensions).

The performance assessment of procurement contracts may follow two distinct objectives. The first relies in the performance assessment of the use of public funds. Recent reforms in the French budgeting process encourage such an assessment since the organic law on public finance² enacted in 2001. The stakes of such an analysis are the following: Has the department paid a fair price for the good or service? Has this department gotten the expected technical performance? Parliamentary missions and some analyses aim at assessing performance of procurement contracts in that perspective (French department of finance - Minefi [2004]- and Damm [2006]). The second possible objective of performance assessment is to appreciate the governance structure choices. In this perspective, analyses aim at appreciating the institutional, organizational and contractual choices used to procure equipments or services (Saussier & Yvrande-Billon [2005]; Chong, Huet & Saussier [2006]). According to the motivation for assessing performance, the methodology is expected to differ. In this article, I am interested in the appreciation of the governance choices, the contractual choices in particular. The methodology developed in this article is associated to this task.

I resort to the transaction cost economics to address this methodological matter. The performance assessment methodology developed by this framework relies on the alignment principle (Williamson [1985]): The governance choices are expected to be aligned with the transaction attributes (frequency, asset specificity and uncertainty) so as to minimize the governance costs. Two tests are run in the literature. The first test aims at measuring the degree of alignment between the transactions attributes and the governance structure to conclude on the *a priori* performance (Adler & Scherer [1999] for instance in the defense procurement sector). The second test checks the impact of misalignment on performance by resorting to performance indicators. The objective of this test is to conclude on the *a posteriori* performance.

¹ Defense procurement contracts are written agreements between the defense procurement agency (representing the government) and contractors. The purpose of these agreements is to develop and realize weapon equipments.

² This is the « Loi Organique relative aux Lois de Finances » - LOLF.

In that perspective, performance indicators used in the empirical works resorting to the transaction cost theory are various and are regarded as given most of time. For instance, Mayer [2000] and Mayer & Nickerson [2002] refer to cost / benefits analyses, Silverman et al. [1997] and Bigelow [2003] use an indicator focused on the survival of organizations, while Poppo & Zenger [1999] and Ménard & Saussier [2002] resort to the quantity of goods or services traded. In the defense procurement sector, Hiller & Tollison [1978] use the price of the contract as the sole indicator performance, whereas the choice of one (or several) performance indicator(s) in this sector is far from being obvious, partly because of the various objectives of the transaction partners as it will be developed in this article. Besides, let us note that the choice of those indicators is central in the performance assessment process. Indeed, the conclusions of the performance assessment, and its explanation, directly depend on the performance indicators used. A change in the latter leads to a change in the former. At the same time, the transaction cost theory does not present a methodology to justify the performance indicators. The importance of the choice of these indicators and the absence of methodology in the transaction cost framework to identify the performance indicators justify running a methodological analysis intended for establishing such a proof.

That is why this article is devoted to methodological developments, within the transaction cost economics framework, aiming at justifying the performance indicators that can be used to appreciate the governance structure choices. As enounced previously, the application case is the defense procurement sector. In this article, I suggest an extension of the usual characterization of the transaction attributes to justify the performance indicators.

This article is composed of two sections. Whereas the section 1 deals with the determinants of the performance indicators by developing theoretical arguments, section 2 is focused on the application of the methodology presented in the previous section. Performance indicators are presented for both the defense procurement agency and the contractor(s).

1. METHODOLOGY OF PERFORMANCE INDICATORS IDENTIFICATION

The purpose of this section relies on the development and presentation of a methodology that can be mobilized to justify performance indicators in the defense procurement sector. The developments are included within a transaction cost perspective. Thus, the base unit of analysis is the transaction. Two subsections compose this section. While the first subsection highlights the importance of the partners' objectives followed in the transaction, the second section points out the determinants of these objectives.

1.1 The central role of the transaction objectives

Several authors have pointed out the necessity to align performance indicators to the partners' objectives (Antle & Smith [1986], Lazear [1989], Baker, Gibbons & Murphy [1994]; Feltham & Xie [1994]; Chatin et al. [1994] and Baker [2000] for instance). Two arguments justify such an alignment. The first relies on the informational function of performance statistics. Analysts expect to draw information from performance statistics: What is the degree of realization of the objectives? How can this performance be explained? The paradigm *Goal, Question, Metrics* (Mashiko & Basili [1997]) relies on the information function of performance indicators. This paradigm enounces the following process: defining goals, deriving questions, developing metrics and making decisions thanks to the performance statistics collected. This article is situated in the following of this paradigm.

The second reason why the performance indicators are expected to be aligned with the partners' objectives relies on the potential incentive function of performance indicators. The latter can be introduced in the payment formulae, which makes the price paid dependent on the performance of the relation. If a misalignment exists between the objectives and the performance indicators, the partners' efforts are likely to be suboptimal. In a context of multi-tasking (Holmstrom & Milgrom [1991]), the alignment between the objectives and the tasks to accomplish is crucial to favor the realization of all tasks that participate to the determination of the transaction value. In that perspective, Feltham & Xie [1994] stipulate that "Increasing the number of performance measures may increase the set of implementable actions, and thereby may result in the implementation of a more preferred action" (p. 439).

These two arguments justify the definition of a performing contract enounced in the introduction. Although the link between the objectives and indicators can be regarded as intuitive, scholars interested in it can refer to two managerial methods: The *balanced scorecard* (Kaplan & Norton [1992], [2005]) and the *tableau de bord* (Bourguignon, Malleret & Norreklit [2004]). In this article, the link between these two variables is favored by the identification of the different components of the objectives (see section 2). To the extent that the transaction objectives are central in the identification of performance indicators, I turned the analysis to the determinants of the objectives.

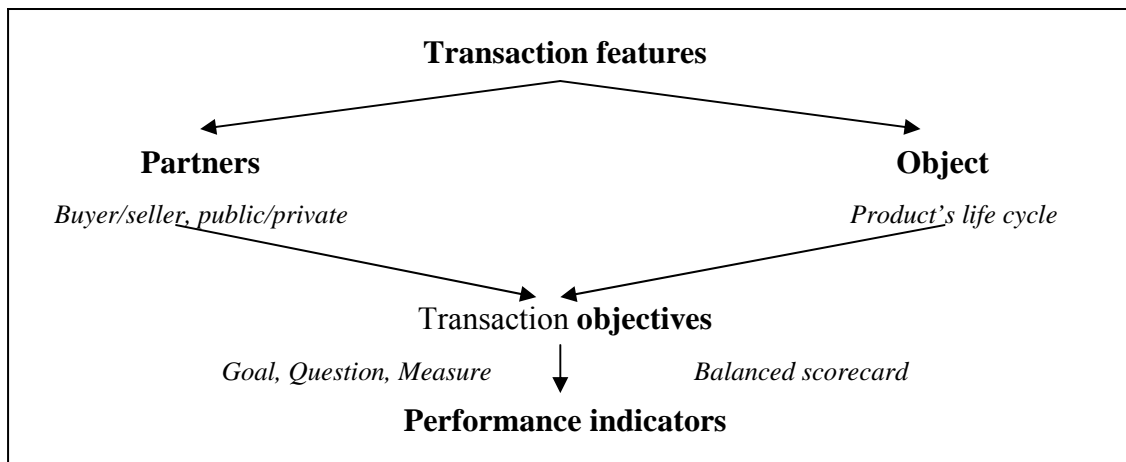
1.2 The determinants of the transaction objectives

In this subsection, I present arguments indicating that the transaction objectives are a function of both the object of the transaction and the intrinsic features of the partners. These two variables are analyzed successively.

The object of the transaction can be characterized by different variables: asset specificities necessary to realize it, uncertainty and the product's life cycle in which the contract object is included. In this article, I point out the consequences of the product's life cycle on the transaction objectives. As a matter of fact, in the defense procurement sector, specific objectives are associated with each cycle, mainly characterized by their maturity levels. Research and technology contracts aim at maximizing (and defining) the technical abilities; research and development contracts look for reaching these technical abilities through the realization of a prototype; production contracts tend to validate the previous efforts through the realization of the equipment (in mass-production or not); and maintenance contracts aim at insuring the use capabilities of these equipments.

Besides, the transaction partners' intrinsic features refer to two factors. First, these features vary according to the partners' position: Buyer or seller. Whereas the buyer is interested in getting the equipment or service with a low price and high quality, the seller looks for the reduction in its implementation costs, which may cause adverse effects on the quality (Hart, Shleifer & Vishny [1997]). Second, the partners' objectives depend also on its nature: public or private. Whereas a public organization looks for the realization not only of its own objectives but also of the public authorities' in general, a private organization is in quest for its sole personal interest. Thus, it is suggested that the partners' intrinsic features directly influence the transaction objectives.

These developments call for an extension of the usual characterization of transactions (asset specificity, uncertainty, frequency) to the determinants of the performance indicators so as to justify the latter. The object of the transaction (through the product's life cycle) and the intrinsic features of the transaction partners (buyer/seller, public/private) are expected to be introduced within the analysis to justify the transaction objectives, and thus the performance indicators. Each of these two variables leads to specific performance indicators to the extent that some of them are explained by the partners' features, while others are justified by the product's life cycle. The following scheme illustrates this result.



Scheme 1: Determinants of the performance indicators

Now that the methodology of performance indicators identification has been developed, the analysis is turned to the application of this methodology in the defense procurement sector.

2. PERFORMANCE INDICATORS IN THE DEFENSE PROCUREMENT SECTOR

The purpose of this section is to present performance indicators that can be used to assess performance of defense procurement contracts when the analytical objective of such an assessment is to appreciate the governance choices. Most of these indicators are common to all products' life cycles, while some of them call for dedicated indicators. This section is composed of two subsections. Whereas the first deals with the defense procurement agency's case, the second subsection focuses on the contractor(s). In each of these subsections, I start by presenting the transactions objectives, deduct indicators valid for all product's life cycles, before developing indicators exclusively dedicated to some of these cycles.

2.1 The defense procurement agency's performance indicators

2.1.1 From the agency's features to indicators common to all contract objects

The defense procurement agency's role is to procure defense equipments or services on the behalf of the state. It is a public organization positioned between the military forces and the state. As a consequence of its public nature, this agency follows its own objectives but also the public authorities'. Its own objective is the minimization of transaction costs. The defense

procurement agency aims at minimizing costs induced by the procurement process. This is an efficiency goal.

The other objectives followed by the agency come from the military forces and from the state. The military forces ask the defense procurement agency to procure equipments with high technical abilities. The reason for it relies on the necessity to favor the superiority of the users on their opponents during operations (Rogerson [1989] p.1286)³. This can be regarded as an efficacy objective.

Besides, the state demands the defense procurement agency to minimize procurement prices (in line with the budget constraint) and to favor the autonomy of the procurement process regarding foreign contractors. Indeed, the state wants to be independent from foreign states for political and strategic reasons. The procurement of one crucial defense system could be traded against a military intervention in a specific theatre of military operations for instance. To be self-governing, the state needs to rely on a large and competitive national defense industrial base⁴. The more developed the national defense industrial base, the higher its ability to realize complex defense systems, the more likely the state is able to procure defense abilities without resorting to foreign firms; all things equal. That is why the state asks the defense procurement agency to support the defense industrial base's development. This is an efficacy objective.

To sum up, the defense procurement agency follows both efficiency and efficacy objectives belonging to the acquisition policy (getting the best equipment at the lowest possible price) and to the industrial policy (favoring the development of the defense industrial base). Four objectives are followed by the public buyer: Minimizing price, respecting expected delays, reaching the defined technical targets, and sustaining the development of defense firms. During the enforcement of procurement contracts, the defense procurement agency needs to trade-off between these different objectives. These general objectives are explained by the defense procurement agency's features as a public buyer.

³ This relation between the military forces and the defense procurement agency partly explains a source of inefficiency in this sector: The technophile bias. The latter represents over technical skills compared with the real operational needs and with the funding abilities, which leads to over quality of equipments (Rogerson [1990] p.84).

⁴ Dunne [1995] defines the defense industrial base as being "a sector or groups of industries that are dependent to some degree on defense spending and upon which the state is dependent for some degree of self sufficiency in the production of the means of defense and war" (p.401).

To deduct performance indicators from these objectives, I point out the existence of components of some objectives. Performance indicators are then directly drawn from these different components. Let us analyze the different objectives successively.

For instance, the price minimization objective is constituted by a result component (the price) and by three components of means (transaction costs, production costs and risk bearing costs). Besides, the delay objective is composed of delays occurring before the contract signature and after this signature. The following table summarizes the performance indicators, comments follow.

OBJECTIVES	COMPO- NENTS	DEFENSE PROCUREMENT AGENCY PERFORMANCE INDICATORS	N° of the indicator	SUGGESTED BY THE MINEFI [2004]
Price minimization	Price	Contract price overrun = effective price of the contract / initial contract price	1	
		Unitary price overrun = effective unitary price / initial unitary price expected in the contract	2	
	Transaction costs	(Ex-ante transaction costs + monitoring transaction costs) / effective contract price	3	
		Late payment penalty / effective contract price	4	Yes
		Retraction compensations / effective contract price	5	
		Compensation for breach of contract	6	
		Judicial expenses / effective contract price	7	
	Production costs	Renegotiation costs / effective contract price	8	
	Risk bearing costs	Insurance cost	9	
		Transaction costs implied by the settlement of organizational or contractual guaranties aiming at risks mitigation	10	
Financial impact of risks when they occur		11		
Respecting delays	Ex-ante delays	Contractor selection duration / total contract duration (maintenance duration not included)	12	
		Negotiation duration / total contract duration (maintenance duration not included)	13	
		Effective contract notification duration / expected contract notification duration	14	
	Ex-post delays	Realization rate of principal equipments	15	Yes
		Effective contract realization duration / expected contract realization duration	16	
Reaching the defined technical targets		Average realization rate of the technical performance targets	17	Yes
Sustaining the defense industrial base		Number of small and medium-sized businesses participating in the contract	18	
		Number of technical abilities maintained thanks to the contract	19	
		Number of technical abilities that worth the export market	20	
		Number of export contracts bearing on the same equipment as the (national) contract	21	

**Table 1: The defense procurement agency's performance indicators
common to all contracts' objects**

The interpretation of absolute prices being very delicate in the defense procurement sector because of the lack of benchmarks, only internal relative indicators have been suggested. Besides, no indicator is indicated to represent production costs since the information held by the defense procurement agency on this variable cannot be regarded as reliable (weaknesses of the cost audits). Eventually, let us note that the number of performance indicators

suggested here is much higher than analyses focused on the performance assessment of the use of public funds (Minefi [2004]; Damm [2006]).

In this subsection, the role of the transaction partners' features on the determination of the performance indicators has been emphasized. The role of the product's life cycle in that perspective is pointed out in the following subsection.

2.1.2 From the contracts' objects features to dedicated indicators

Two product's life cycles call for dedicated assets since the objectives followed in these cycles are partly specific. These are the research and maintenance contracts. The latter is constituted by two result components: Availability and price, along with the defense procurement agency objectives. The table 2 presents the performance indicators suggested for these contract objects.

SPECIFIC OBJECTS	COMPONENTS	DEFENSE PROCUREMENT AGENCY PERFORMANCE INDICATORS	N° of the indicator	SUGGESTED BY THE MINEFI [2004]
R&T and R&D		Progression rate of the technical abilities	22	Yes
Maintenance	Availability	Reaction delay for realizing repairs	23	
		Technical availability rates of equipments	24	Yes
		Unavailability rates caused by production weaknesses	25	
	Price	Maintenance price / effective total contract price (maintenance not included)	26	
		Reliability rate / effective price of maintenance	27	

Table 2: Defense procurement agency's dedicated performance indicators to research and maintenance contracts

Now that the defense procurement agency's performance indicators have been presented, let us turn the analysis to the case of the contractor(s).

2.2 The contractor(s) performance indicators

As in the previous section, I start by pointing out the impact of the contractors' features on the performance indicators before analyzing dedicated indicators specific to research and

maintenance contracts. A third section is focused on the status of all performance indicators presented in this article.

2.2.1 From the contractors' features to performance indicators common to all contract objects

The contractors develop and produce defense equipments. Firms can also maintain these equipments in availability states. In the defense procurement sector, the contractors are private⁵. As a consequence, they follow their own objectives: Maximizing profits and favoring their development in the long run. These two objectives are partly interconnected.

Each of them is composed of different components. The maximizing profits objective is constituted by a result component (profit) and different components of means: Transaction costs, production costs, risk-bearing costs and price. Besides, the components of the long-run development objective are focused on three variables: Costs, delays and technical performance. These variables are central because they matter in both dimensions favoring the contractor's long-run development: Getting both national contracts and export contracts. First, these variables represent the objectives of the national defense procurement agency. Satisfying the sole national buyer is an imperative for getting other contracts in the future, not only in the national market but also abroad for credibility reasons (Kovacic [1991]). Second, performing in the cost – delays – technical performance variables is favorable argument in any bargaining in the international stage for export contracts. That is why these variables are used as components of the contractor's long run development objective.

The following table presents the contractors' performance indicators valid for all contracts whatever their objects might be.

⁵ Most of the defense industrial countries have only private contractors. The American firms have been privatized in the 1990's, followed by British firms, while French defense contractors were made private in early 2000's.

OBJECTIVES	COMPO- NENTS	CONTRACTORS PERFORMANCE INDICATORS	N° of the indicator	COMMON TO THE BUYER
Profit maximizing	Profit	Realized profit rate / expected profit rate when the contract was signed	1	
	Transaction costs	ex-ante transaction costs / effective contract price	2	
		Monitoring transaction costs / effective contract price	3	
		Penalty for delays (exoneration not included) / reference price contract	4	
		Liberatory penalty / reference price contract	5	
		Judicial expenses / effective contract price	6	Yes
		Renegotiation costs / effective contract price	7	Yes
	Production costs	Realized production costs / expected production costs	8	
	Risk-bearing costs	Insurance cost	9	Yes
		Transaction costs implied by the settlement of organizational or contractual guaranties aiming at risks mitigation	10	Yes
		Financial impact of risks when they occur	11	Yes
		Refunding costs in the capital market	12	
	Price	National contract price / export price (taking into account the differential in the cost structure between national and export contracts)	13	
		Effective price / reference price contract	14	
		Date of account payments / dates initially expected	15	
Long run development	Costs	See the previous indicators		
	Delays	Negotiation duration / total contract duration (maintenance duration not included)	16	Yes
		Effective contract realization duration / expected contract realization duration	17	Yes
	Technical per- formance	Average realization rate of the technical performance targets	18	Yes
		Number of technical abilities maintained thanks to the contract	19	Yes
		Number of export contracts bearing on the same equipment as the (national) contract	20	Yes

**Table 3: The contractor's performance indicators
common to all contracts' objects**

As opposed to the defense procurement agency's situation, an indicator has been deducted from the production costs component. The contractors have reliable information on their production costs. Besides, let us note that some performance indicators are common to both transaction partners. Any performance assessment is expected to pay a special attention to those indicators, although their interpretations are not identical for the different transaction

partners. Let us turn the analysis to dedicated performance indicators to two product's life cycles: Research and maintenance.

2.2.2 From the contracts' objects features to dedicated indicators

The indicators presented in this section are the same as in section 2.1.2. Three indicators have been added: The mean time between failure, which is already used by contractors, and two indicators representing the cost of maintenance.

SPECIFIC OBJECTS	COMPONENTS	DEFENSE PROCUREMENT AGENCY PERFORMANCE INDICATORS	N° of the indicator	COMMON TO THE BUYER
R&T and R&D		Progression rate of the technical abilities	21	Yes
Maintenance	Buyer satisfaction	Reaction delay for realizing repairs	22	Yes
		Mean time between failures	23	
		Technical availability rates of equipments	24	Yes
		Unavailability rates caused by production weaknesses	25	Yes
	Cost	Effective cost of maintenance / expected cost of maintenance	26	
		Reliability rate / maintenance cost	27	
	Price	Maintenance price / effective total contract price (maintenance not included)	28	Yes
Reliability rate / effective price of maintenance		29	Yes	

Table 4: Dedicated performance indicators to research and maintenance contracts

2.2.3 Status of these performance indicators

The performance indicators suggested in this article are expected to be used in the performance assessment analysis dedicated to the appreciation of the governance choices in the defense procurement sector. The tables 1 to 4 suggest a non-exhaustive list of indicators which is called to be completed over time. The main point is to resort to a common list of indicators to consolidate information collected in such performance assessments so as to compare statistics and conclude on the relevancy of the governance choices.

Although all indicators can be applied to all the defense procurement contracts, some are likely to be more relevant than others from an empirical point of view in various situations. The knowledge on the precise relevancy of these indicators is not precise enough to select some of them by the time being. That is why these indicators are expected to be suggested to

the people responsible for the management of contracts, in both the defense procurement agency and the contractors. Their preferences will be analyzed, which is likely to refine the understanding of this sector. The latter is also expected to be favored thanks to the interpretation of performance statistics. By analyzing the performance statistics associated with these indicators, trade-offs between the various objectives can be taken into account, which favors the understanding of the contract enforcement. Thus, resorting to a large number of indicators favors the performance assessment (knowledge objective) and its interpretation (understanding objective).

CONCLUSION

The developments presented in this article are included within the transaction cost theory framework. I suggest an extension of the usual transaction characterization (asset specificity, frequency and uncertainty) to the determinants of the performance objectives (the object and partners' features). The product's life cycle(s) and the public/private and buyer/seller features are expected to be taken into account in the analysis. This extension is likely to favor the justification of the performance indicators used to assess performance when the appreciation of the governance choices is aimed.

The application case of these methodological developments is the defense procurement sector. The theoretical methodology developed in this article made possible the identification of the foundations of the partners' objectives presented in the specialized literature, which favors the understanding of this sector. Besides, the application of the methodology has been the opportunity to suggest performance indicators that can be used in this sector.

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