

## IN SEARCH OF EFFICIENT AND EFFECTIVE DEFENCE PROCUREMENT: AN AUSTRALIAN CASE STUDY

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### ABSTRACT

Australia has long sought to improve the efficiency and effectiveness of procurement for national defence through refined institutional arrangements and increasingly professional acquisition personnel. The Defence Materiel Organisation (DMO) is the dedicated, semi-detached procurement arm of the Australian Defence Organisation (ADO). Recent reviews of defence procurement function called for greater commercial orientation of the DMO and employment of ex-private sector staff to make its operations more business-like. In this paper, we use an analytic framework adapted from Hart et al (1997) to compare and contrast the conventional, in-house procurement agency with a more commercially-oriented defence procurement agency broadly modelled on the DMO. We argue that the relative efficiency of these two stylized arrangements depends on how procurement function is integrated into the governance structure of the ADO and, in particular, on how different incentive regimes are applied to motivate procurement personnel to improve service delivery.

**Key words:** defence procurement, contracting out, incomplete contracting, governance and ownership incentives

**JEL Classification Code:** H44 publicly provided goods: mixed markets

## INTRODUCTION

This paper is about the *defence procurement function*. As such it addresses *how* military materiel is procured as opposed to *what* is purchased. The *defence procurement function* includes scanning the market for potential sources of supply, soliciting supplier offers, managing tenders and source selection, drafting and executing procurement contracts, managing acquisition and logistic support projects, and providing procurement advice to military capability managers. In most countries, the defence procurement function is undertaken by a specialised organisational element, which we label the Defence Procurement Organisation (DPO). The latter is usually an “in-house” element of Defence but it may also be detached from it to operate as a quasi-autonomous agency as it presently does in Australia.

This paper has been prompted by recent Australian government efforts to secure better procurement outcomes by improving the performance of the Defence Materiel Organisation (DMO), the procurement arm of the Australian Defence Organisation (ADO or “Defence” in what follows). The traditional in-house DPO has been criticized extensively in Australia for its alleged failure to deliver materiel of the required quality, on time, and within budget. Consequently, governments have sought alternative defence procurement arrangements while retaining the ownership (residual rights of control) of the DPO.

The DMO was formed in 2000 to consolidate responsibility for both acquisition and through-life support of military materiel in a single organisation. It operates as an agency of the Defence portfolio, responsible for supporting Defence capabilities through acquisition and through-life support of military equipment. However, its performance and *modus operandi* have been criticised in Parliament, the press and elsewhere. The latest of several external reviews of the efficiency and effectiveness with which DMO manages defence procurement concluded that “further improvements to procurement and sustainment could not be achieved without a greater degree of *business acumen* and *commercial discipline* being applied” (Mortimer, 2008: ix - our italics). To this end the review recommended detaching the DMO from the Department of Defence while keeping it accountable to the defence minister – an arrangement we discuss further in the following section.

To assess the effectiveness of alternative governance arrangements of the publicly-owned DPO, we outline below two stylized service delivery models:

- the conventional in-house provision of procurement services by an organisational element within Defence (*in-house DPO model: IDPO*); and
- provision by an agency that is publicly-owned but detached from Defence (*statutory DPO model: SDPO*).

The two models draw on the Australian experience and each involve different forms of governance of a publicly-owned procurement organisation. Each of these models involves a single service provider, the DPO, and a single ‘customer’ for its services: Defence. We further assume that the materiel user (i.e., Services) is responsible for determining what is needed, including the approval of the deliverable and commissioning it into service, while the DPO is restricted to the role of intermediary between the customer and the materiel supplier.

The analytic framework we use to evaluate the above options is an adaptation of that developed by Hart *et al* (1997) to explore cost-(efficiency) and quality-related (effectiveness) aspects of service delivery under different institutional arrangements. We have adapted this framework to make it better suited to the assessment of alternative service delivery models under the same mode of ownership as opposed to those involving different ownership arrangements as originally considered by Hart *et al* (1997).

We use the adapted framework to determine the necessary (equilibrium) conditions for the efficient operation of each service delivery model: IDPO and SDPO. We subsequently set out four propositions comparing the two models and highlighting their relative effectiveness.

We conclude the paper with a comment on relative merits of the two service delivery options. We argue that the superiority of any particular model depends on the adopted governance structure and the associated incentive regimes.

This paper draws on our earlier analysis of alternative service delivery arrangements that allow for both differences in the form of activity governance and different modes of ownership (see Markowski and Wylie, 2010). The two papers share essentially the same methodology in assessing alternative ways of providing procurement services. However, our earlier work was largely focused on the scope for privatisation and contracting out of the defence procurement function, an option explicitly rejected by successive Australian governments. In this paper we confine our interests to alternative modes of service delivery by public sector agencies. The IDPO and SDPO models represent the end points of a broad continuum of institutional arrangements which allow policy makers to choose between different institutional models that involve

combinations of traditional, in-house arrangements and those involving the use of quasi-commercial service delivery arrangements.

### **BACKGROUND: AUSTRALIA'S SEARCH FOR AN EFFICIENT AND EFFECTIVE DEFENCE PROCUREMENT MODEL**

Australian defence procurement arrangements have changed significantly in the sixty years since World War Two. There have effectively been three overlapping phases in the evolution of the defence procurement function in Australia:

- an institutional development phase, beginning with the consolidation of defence capital equipment procurement within a single organisational element within Defence, later extended to include procurement of in-service support services;
- a personnel development phase which focussed on the civilianisation and professionalisation of the defence acquisition personnel, including recruitment of executives with commercial skills/background and efforts to introduce MBA-style Project Management and Acquisition degrees (see Bennett, 1990); and most recently
- a transactional phase characterised by a shift to customer-provider relationships between the Australian DPO (currently the Defence Materiel Organisation) and its Service customers.

This paper focuses on the latest phase in this evolution of the Australian defence procurement function consequent upon the 2003 Kinnaird Review, which called for a separate DMO identity as a prerequisite for the shift to the more “commercially oriented”, performance-driven culture (Kinnaird *et al*, 2003). The Review expressly rejected the option of privatising the DMO and argued that private provision of the defence procurement function did not have and could not have any sensible rate of return target (*Ibid*: 38). He also saw private arrangements as inconsistent with the need for routine interaction with ministers and the parliament resulting from the political and strategic importance of major equipment acquisitions.

But Kinnaird did want the head of DMO to have sufficient power to reject procurement proposals lacking adequate analysis of risk or cost and the authority to provide more flexible remuneration to attract the highly skilled staff required to manage large procurement projects effectively (*Ibid*: 35). To this end, the Review canvassed the

following organisational options for a more independent public sector agency:

- establishing the DMO as a *prescribed agency* within the Defence portfolio, subject to Defence personnel and other controls but with a *separate financial identity and authority*;
- establishing the DMO as a *separate department of state*;
- creating a *statutory authority* within the Defence portfolio under its own act of parliament; and
- establishing it as an *executive agency* (with considerable autonomy in both financial and employment matters), located within the Defence portfolio (*Ibid: 35-38*).<sup>i</sup>

The then government agreed to establish the DMO as a more financially autonomous ‘prescribed’ agency but rejected the Review’s recommendation to grant it greater autonomy in employment matters by establishing it as an executive agency.

In 2008, a newly elected government commissioned another review of defence procurement (Mortimer, 2008). The 2008 Mortimer review was prompted by several high profile “problem acquisition projects” inherited by the new government from its predecessors. Mortimer argued that previous reforms of the DMO had not delivered the necessary accountability, authority, independence and control over inputs for the DMO to be fully results driven, commercially oriented and have full control over its business (Mortimer, 2008: 45). And, like Kinnaird, the review also recommended establishing the DMO as an *executive agency* by broadening its current status as a *prescribed agency* with a view to make it fully accountable for its performance and more transparent in its financial and non-financial operations. The executive status would also give the DMO Chief Executive Officer full control of personnel inputs. The government eventually rejected Mortimer’s argument for much the same reasons its predecessors had rejected Kinnaird’s arguments five years earlier.<sup>ii</sup>

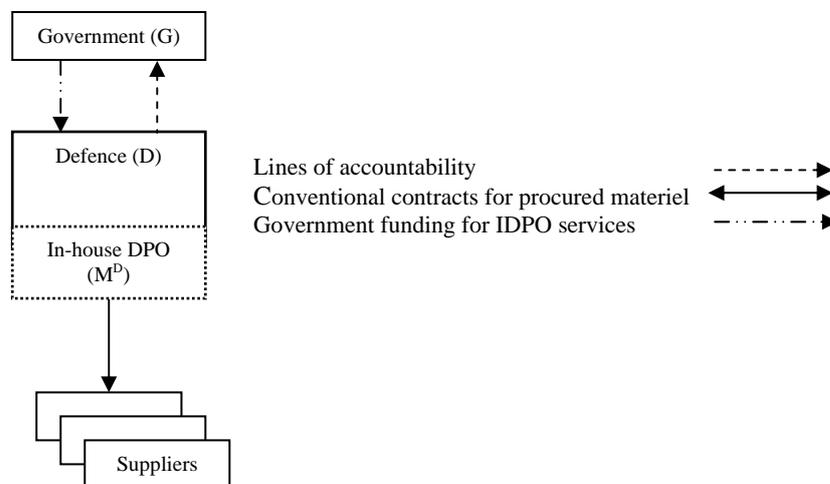
To assist policymakers interpret and learn from these manoeuvrings and experiments in institutional design, we now outline two alternative public sector service delivery models that can be contrasted and compared: an in-house defence procurement organisation, IDPO, and a semi-detached, statutory Defence Procurement Organisation, SDPO.

## STYLIZED SERVICE DELIVERY MODELS

### In-house model

We start with the conventional in-house provision of defence procurement services by an internal organisational element of Defence. Hereafter we refer to this as the in-house defence procurement organisation, IDPO. The government, G, is the owner of the IDPO in that it has ‘residual rights of control’ and, thus, “authority to approve changes in procedure or innovations in uncontracted-for contingencies” (Hart *et al*, 1997: 1132). These residual rights of control are delegated to Defence, D, which acts as the IDPO’s *de facto* owner. For example, the IDPO could be set up as a cost centre within D or as one of its functional divisions. To avoid agency problems in this stylized representation, we assume that G is represented by a single politician, D by a single bureaucrat, and IDPO by a single manager-worker,  $M^D$ , who is a conventional salaried public servant. The in-house DPO structure is shown in **Figure 1**.

**Figure 1** Stylized service delivery options: In-house DPO



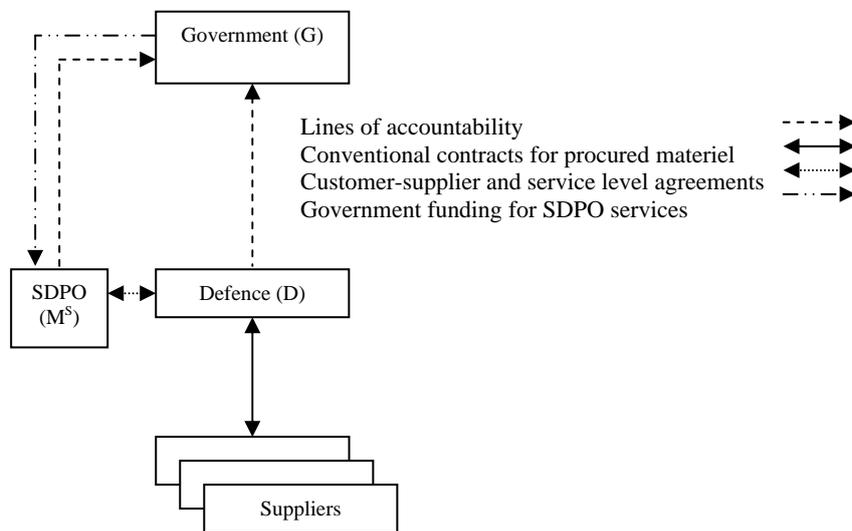
Source: Markowski and Wylie (2010), Figure 1.

### Statutory model

The statutory model of the Defence Procurement Organisation, SDPO, is based on the restructured Australian DMO, which – as a prescribed agency - is organisationally more detached from Defence than the above IDPO model. Ownership of the SDPO is formally vested in the government but the day-to-day application of residual rights of control over the procurement function delegated to Defence

(see **Figure 2**).<sup>iii</sup> That is, the SDPO has enough autonomy to propose changes in procedure or innovations in uncontracted-for contingencies but these must be approved by Defence. We assume D to be the only user of SDPO services but the statutory agency can also be set up, as in Canada, as an all-of-government procurement organisation (Berkok, 2009). The resulting relationship between the SDPO and D constitutes a quasi-bilateral monopoly. Again, to avoid agency problems, we assume that G is represented by a single politician, D by a single bureaucrat, and SDPO by a single manager-worker,  $M^S$ , who is a public servant on a wage-plus-bonus contract.

**Figure 2** Stylized service delivery options: Statutory DPO



Source: Markowski and Wylie (2010), Figure 2.

The aim of this statutory arrangement is to impose greater “commercial discipline” on the procurement function by establishing a quasi-transactional relationship with D similar to the current *service level agreements* used in Australia. We refer to these quasi-contractual arrangements as “customer-provider agreements”. However, since the SDPO does not sell its services to D and is funded directly by G, it is not clear to what extent this partial detachment from Defence and the use of customer-provider agreements effectively increase “commercial discipline” and make the SDPO “more business-like” than the IDPO. To operate “commercially”, it would have to sell its services to D, i.e., it would have to be established as a government-owned trading entity.

Preferably, it should also be detached from the Defence portfolio and made accountable to another government minister. Further, as a trading entity using taxpayer-funded assets, it would be expected to achieve a satisfactory rate of return on social equity capital under its stewardship. None of these enhancements has been proposed in Australia and, thus, they have not been incorporated in our stylized representation of the SDPO.

### **EVALUATION FRAMEWORK**

To assess the effectiveness of these two alternative service delivery arrangements, we have adapted the Hart *et al* (1997) model of choice between the public or private provision of a good or a service. Like Hart *et al* (1997), we analyse cost and quality improvements under conditions of “incomplete contracting” (see below). However, in our model the choice is between alternative organisational arrangements for service delivery as both the IDPO and the SDPO are publicly owned. We follow Hart *et al* (1997) in assuming that information about the nature of service to be delivered is symmetric under public service provision. Thus, all potential process and product innovations are visible to the “owner” (Defence, D, and ultimately Government, G), who is the activity’s sole customer. In our modified framework, differences in organisational structures and, in particular, in governance arrangements (as opposed to the mode of DPO ownership) are used to explain the likely differences between the IDPO and the SDPO with regard to their ability to innovate new service delivery processes and improve service quality.

#### **Decision-making framework and incomplete contracting**

Under each service delivery option, D must specify the scope of the required procurement, say, functional specifications of military systems to be acquired, and, co-jointly with the DPO, the broad scope of the procurement task needed to facilitate that acquisition. Next, it must either direct  $M^D$  to determine the specifics of the required procurement service in consultation with relevant “customer” elements within Defence (IDPO option) or agree the draft terms of customer-provider arrangement with  $M^S$  (SDPO option). In either case it must reach an understanding with the service provider regarding the nature of the procurement task to be performed. At this stage, though, there is considerable uncertainty as to what best suits D’s requirements (i.e., detailed specifications of the deliverable and the acquisition process have yet to be finalised). Hence the specifics of the required procurement facilitation task are commensurately uncertain.

Given this pervasive uncertainty about the exact scope of the required procurement (service) task, these initial service provision arrangements are unavoidably vague and we refer to them as (incomplete) *initial contracts*. Also, we refer to procurement services described in these initial contracts as the *basic service*. That is, initially, Defence cannot enter into contractual arrangements with service providers that are ‘complete’ enough to take into account every conceivable state of the world that might influence what is to be procured and how it should best be delivered. Although incomplete, these initial contracts may nevertheless require long-term commitments by those concerned, especially when they have to make significant relationship-specific investments. As (*ex ante*) initial contracts are *incomplete*, the possession of residual rights of control is critical for making and/or approving *ex post* adjustments to these incomplete contracting arrangements between D and service providers, IDPO and SDPO (Grossman and Hart, 1986).<sup>iv</sup>

### **Process and product innovation**

Given the incompletes of the initial specification of the procurement service to be delivered, under each service delivery option, the DPO manager, M, can change service quality and cost by making a personal effort (non-monetary investment) “the returns to which accrue at some later date” (Schmidt, 1996b: 574). For example, M may try to become more market-savvy to make good source selection decisions that will enhance the quality of service he/she provides for D. Alternatively, M can learn new ways of ‘doing business’ to reduce the unit cost of service he/she provides for D. This innovative effort is measured in terms of its disutility (cost) to M. For example, if M makes effort  $e$  to reduce service delivery costs (cost innovation), his/her personal disutility is  $e$ . Similarly, when M makes effort  $i$  to improve service quality (product or quality innovation), his/her personal disutility is  $i$ . M’s cost and quality innovation initiatives may not be directly observable by D, only by M.<sup>v</sup> Once the service is delivered, it yields B benefit for Defence (and, given the assumed unitary decision making framework, for Government, G, and society at large). This benefit represents the service provider’s contribution to the production of national security.<sup>vi</sup> Since B is not observable and verifiable by a third party, it cannot be formally contracted. However, we follow Hart *et al* (1997) and represent it in dollar terms. The DPO’s service delivery costs are shown as C and are also measured in dollars.

Under the IDPO and SDPO arrangements,  $M^D$  and  $M^S$  must obtain the D’s consent before they implement desirable cost and product innovations. We assume that the public sector is a unitary decision maker, that there are no informational asymmetries between different government agencies and that potential quality improvements and

cost efficiencies are equally visible to D and G under the IDPO and SDPO models.<sup>vii</sup> In particular, even though the initial contract is vague, there are no informational asymmetries between D and the service provider. Put another way, D must be fully informed by M about  $e$  and  $i$  opportunities that M wishes to pursue. However, neither  $e$  nor  $i$  can be verified by a third party and therefore cannot be formally contracted. This enables Defence to assess the net benefit of all proposed innovations taking into account the possible negative impact of cost innovation on service quality and vice versa. Also, neither  $M^D$  nor  $M^S$  have an incentive to invest in cost and quality innovation unless their efforts are recognised by D so that they can capture at least a proportion of benefits from their innovative efforts (see below). When cost savings- or quality improvement-related surpluses are to be negotiated by the parties, we assume that they would use Nash bargaining to split potential gains 50:50.

When M makes innovative efforts  $e$  and  $i$  to reduce service provision costs and enhance service quality,  $c(e) \geq 0$  denotes the reduction in cost due to the cost innovation;  $b(e) \geq 0$  denotes the *reduction* in quality due to the cost innovation, and  $\beta(i) \geq 0$  is the service quality enhancement due to the service quality innovation. Thus

$$B = B^0 - b(e) + \beta(i)$$

$$C = C^0 - c(e),$$

where  $B^0$  and  $C^0$  are respectively the initially agreed benefit and cost of provision of the basic service while B and C are the corresponding *ex post* measures. M's cost saving and service improving efforts must be added to C to obtain the overall cost of provision

$$C + e + i = C^0 - c(e) + e + i.$$

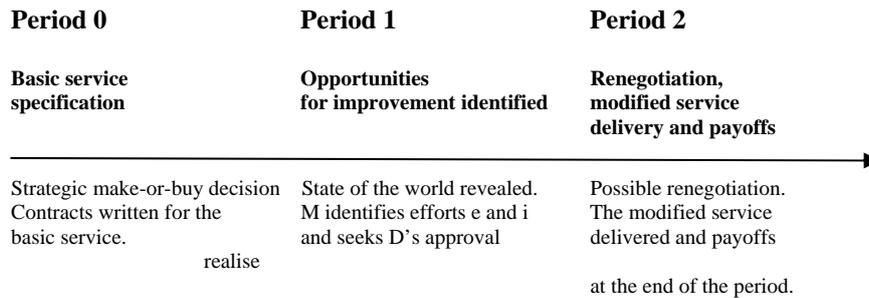
In this framework, we can keep track of separate impacts of cost innovation on cost and service quality ( $c$  and  $b$ ) but we are not concerned with the potentially adverse impact of product innovation on cost. In this respect, we follow Hart *et al* (1997: 1133-1134), who see function  $b(e)$  as critical to this approach as “it measures how much (noncontractible) quality falls because of a (noncontractible) cost cut, and hence serves as the variable that critics of privatization focus on”.<sup>viii</sup>

### **Decision-making timeline**

Under both service delivery options, the basic service is likely to change as particular states of the world materialise and when the service provider suggests process (cost) and product (quality) improvements. As the basic service described in the initial contract is modified following negotiations between D and M, it becomes the *modified service* and the initial contract is “amended” to become the

*modified contract*. There is a common decision timeline for both service delivery options (see **Figure 3**).

**Figure 3** Decision-making timeline



Source: Hart *et al* (1997), Figure I: 1135.

In period 0, Government, G, decides whether to set up the SDPO or continue conventional in-house service delivery by the IDPO. Depending on the outcome of this “strategic” decision, either D makes internal arrangements to have the basic service delivered in-house, or the SDPO is set up and enters into a service provision agreement with D. Neither of these initial arrangements is complete as only the basic service can be specified in period 0.

In period 1, the actual state of the world becomes apparent and the DPO manager, M, identifies opportunities for cost and product innovations and negotiates with Defence which of these should best be implemented. Thus, at the beginning of period 2, M and D may renegotiate the initial contract to take into account the proposed cost and quality improvements: the modified service. The latter only includes those process and product modifications that have been approved by D and M has no incentive to implement other innovations without D's consent.<sup>ix</sup> Under both service delivery options, the payoffs for the parties are realised at the end of period 2.

### **Incentives and default payoffs**

Managerial incentives to innovate also depend on how such efforts are rewarded under alternative service delivery arrangements. As both  $M^D$  and  $M^S$  are employed in the public sector, they have no equity interest in the DPO and, in addition to a wage, they may only be offered a performance-based ‘loading’, say, a bonus related to their cost and quality innovation efforts  $e$  and  $i$ . As  $M^D$  and  $M^S$  are hired under different arrangements, we assume that  $M^D$  is a conventional salaried public servant receiving no performance-

related bonus while  $M^S$  receives wage and a performance bonus based on the value of his/her innovative efforts  $e$  and  $i$  approved by  $D$ .

We follow Hart *et al* (1997) and define  $\lambda$  as an appropriation coefficient that measures the fraction of the direct net gain from cost and quality innovation that is captured by  $M$ , where  $0 \leq \lambda \leq 1$ , and  $(1 - \lambda)$  as a fraction captured by Defence (and ultimately  $G$ ). The public manager is unlikely to be offered a bonus equal to the whole amount of the net social gain from his/her innovation as once innovative ideas are revealed,  $D$  may replace  $M$  with another manager hired to implement proposed improvements and paid at cost. Thus,  $D$  has to pay only what is strictly necessary to encourage innovative ideas,  $(1 - \lambda)$  is likely to be large in the public sector and most benefits of cost and product innovation are appropriated by  $D$  and ultimately  $G$ . By assumption,  $\lambda^D = 0$ , as  $M^D$  receives no bonus under the IDPO option, and  $0 < \lambda^S < 1$  for  $M^S$  and  $0 < (1 - \lambda^S) < 1$  for  $D$  under the SDPO option. However, we also assume that some innovative activity is likely to occur even when  $\lambda^D = 0$  in the IDPO model (see below).

Under the IDPO arrangement,  $M^D$  is a public servant hired in a market segment in which the government is the monopsonistic employer of all those wishing to enter public service and offered conditions of service applicable to all public employees. If all of such people are alike and act like atomistic job seekers,  $G$  sets the uniform wage,  $w^D$ , that equals their reservation utility,  $\underline{U}^D$ . Thus,  $D$  can replace  $M^D$  by another individual drawn from the pool of identical public servants and offer him/her exactly the same terms of employment. Normally, these conditions of service offer more job security than private sector employment but restrict remuneration levels to well below those prevalent in the private sector.

As noted, although  $\lambda^D = 0$  under the in-house arrangements and  $M^D$  has no bonus-related incentive to engage in cost and quality innovation, we nevertheless expect some in-house cost savings and quality improvements to be proposed by  $M^D$  even though he/she is only paid a fixed wage and receives no productivity bonus,  $\lambda^D[c(e^D) - b(e^D) + \beta(i^D)] = 0$ . To start with,  $w^D$  may *per se* be sufficient to induce a modicum of innovative effort as management is hardly ever a routine activity and job satisfaction is a significant motivator for managers. Generally, we expect  $[c(e^D) - b(e^D) + \beta(i^D)] > 0$  as  $M^D$  is likely to be motivated by non-wage factors such as job satisfaction, promotion prospects, empire building or private reputational capital created through successful cost and quality innovation, which could later be used to improve promotion prospects or find more financially lucrative employment elsewhere.<sup>x</sup> Thus, it is possible to offer  $M^D$  incentives other than the productivity bonus to make him/her invest in cost and product innovation even though the direct net benefit of

that investment in period 2 is entirely captured by Defence (see below).<sup>xi</sup>

These private reputation-related benefits may have a symmetric payoff, especially given the informational symmetry between D and M<sup>D</sup>. In such a case, the net effect could be no incentive to innovate if innovations are only rewarded when successful and symmetrically penalized if not. On the other hand, these private reputational benefits may also have asymmetric payoffs with successes ‘privatised’, i.e., claimed by those responsible for them, but failures fully ‘socialised’, that is, not attributed to anyone in particular and seen as an organisational rather than private failure. In our view, the asymmetric case is more realistic. In many hierarchical organisations, public and private, managers are often promoted on the basis of organisational benefits, which they promise to be deliver at some future date while failures, unless catastrophic, are accepted as the organisational ‘par for the course’ and rarely sheeted back to those originally responsible for them. In this paper, we assume that the managerial payoff is asymmetric as described above.

Let  $\gamma$  be a ‘reputational’ coefficient which ‘converts’ M’s innovative activity to a fraction his/her reputational capital  $\delta R$

$$\delta R = \gamma[e + i], \text{ where } 0 \leq \gamma \leq 1.$$

Thus, increased innovative effort enhances M’s reputation as an effective manager and makes him/her more promotable. In turn, higher level of seniority improve the prospect of finding better paid employment in the private sector ( $\delta R$  is particularly important for younger managers keen to develop their reputational capital to earn promotion or move to more rewarding employment elsewhere). Thus, M’s enhanced reputation can be capitalized as it is normally associated with higher pay either within or outside the public sector. Public sector benefits directly from higher  $\gamma$  as long as the fraction of net social benefit of M’s innovative effort that is captured by D (and ultimately G),  $(1 - \lambda) [c(e) - b(e) + \beta(i)]$ , exceeds the additional wage cost of  $\delta R$ .<sup>xii</sup> In the case of the IDPO, we expect  $\gamma^D > 0$  and, thus,  $\delta R^D > 0$ , even though  $\lambda^D = 0$  and Defence captures all immediate results of M<sup>D</sup>’s innovative activity,  $c(e^D) - b(e^D) + \beta(i^D)$ .

In the SDPO model, M<sup>S</sup> is recruited from the private sector on “commercial” terms, which include a performance-related bonus for approved innovative *efforts*  $e$  and  $i$  (as opposed to outcomes of these innovative activities) in addition to *ex ante* determined (contract) wage,  $w^S$ . M<sup>S</sup> is hired specifically to engage in vigorous innovative activity that requires “business acumen” and “commercial orientation”, that is, the apparently successful commercial track record. To simplify, we assume that M<sup>S</sup> is no longer interested in

enhancing his/her reputational capital so that  $\gamma^S = 0$  and  $\delta R^S = 0$ . We also assume this market segment to be competitive so that competition between job seekers makes the expected wage rate plus bonus equal their opportunity cost/reservation utility,  $(w + \text{expected bonus}) = \underline{U}^S$ . The SDPO pays  $M^S$  the going commercial wage,  $w^S$ , but also offers a performance-related bonus,  $\lambda^S [c(e^S) - b(e^S) + \beta i^S]$ .<sup>xiii</sup> Under this arrangement, the manager's total income is  $w^S + \lambda^S [c(e^S) - b(e^S) + \beta i^S]$ , where  $0 < \lambda^S < 1$ . The appropriation fraction,  $\lambda^S$ , may be high in some cases as  $M^S$  is hired to implement cost cutting and product quality improvements rather than just volunteer ideas for cost and quality innovation. However, we expect  $\lambda^S < 1$  as, ultimately,  $M^S$  is replaceable and, if need be, Defence may threaten to replace a manager after he/she reveals good ideas and hire a cheaper substitute to drive the implementation process. Defence captures the balance of the net benefit of cost and quality innovation,  $(1 - \lambda^S) [c(e^S) - b(e^S) + \beta i^S]$ , which is likely to be large relative to the managerial performance bonus. Defence also takes into account the likely service quality degradation resulting from the proposed cost savings. Thus,  $M^S$  and D must negotiate over innovative efforts  $e$  and  $i$  to determine the exact amount of the managerial bonus.

Let  $y^0$  denote the basic service specified in the initial contract. Under the in-house option, the cost of inputs contracted by D in period 0 is assumed to comprise a fixed cost element,  $C^0$ , and the wage of  $M^D$ , that is,  $C^0 + w^D$ .<sup>xiv</sup> For the SDPO, the cost of inputs contracted by D in period 0 is  $C^0 + w^S + \text{managerial bonus}$ ,  $\lambda^S [c(e^S) - b(e^S) + \beta i^S]$ .<sup>xv</sup> Thus, the following default payoffs are realised under the two service delivery options:

$$B^0 - C^0 - w^D + c(e^D) - b(e^D) + \beta i^D$$

(IDPO)

$$B^0 - C^0 - w^S + (1 - \lambda^S) [c(e^S) - b(e^S) + \beta i^S]$$

(SDPO)

for Defence; and

$$w^D - e^D - i^D$$

(IDPO)

$$w^S - e^S - i^S + \lambda^S [c(e^S) - b(e^S) + \beta i^S]$$

(SDPO)

for the employee-manager, M.

In this framework, the ownership of the DPO matters because the government owner, G, and its delegate, D, have residual rights of control which allow them to obtain information about the possible innovative effort by M. Governance also matters because different organisational elements can be empowered to exercise ownership

rights on behalf of G. In our stylized framework, G delegates the day-to-day exercise of residual rights of control to Defence, D, which is therefore in position to determine the most desirable levels of innovative efforts  $e$  and  $i$  proposed by the DPO manager. In the following section we discuss optimal levels of innovative activity under the two service delivery models.

## EQUILIBRIUM CONDITIONS

### The first-best case

Consider the first-best case which would obtain if the innovation efforts  $e$  and  $i$  were fully contractible in period 0 so that a contract describing the modified procurement service could be written up-front. Under such conditions, Defence and the service provider could jointly maximise the total net surplus from their trading relationship and agree rules to divide it between them afterwards. The first-best outcome is obtained by maximizing

$$\max_{e,i} \{c(e) - b(e) + \beta(i) - e - i\} \quad (1)$$

to determine the marginal benefit and cost conditions

$$c_e(e^*) - b_e(e^*) = 1, \text{ and} \quad (2)$$

$$\beta_i(i^*) = 1, \quad (3)$$

where subscripts denote derivatives. As Hart *et al* (1997: 1137) put it

At the social optimum, the marginal social benefit of spending extra effort to reduce costs, measured to take into account of marginal quality deterioration, must equal the marginal cost of that extra effort, which equals one. Similarly, the marginal social benefit of spending extra effort to improve quality must equal the marginal cost of that extra effort, which again equals one.

### IDPO

In the IDPO model,  $M^D$  identifies potential cost and quality improvements that, given  $\gamma^D$ , he/she wishes to present to D for approval. D chooses the optimum levels of innovative effort by taking into account the expected negative impact of cost saving innovations on quality. There is no renegotiation as  $M^D$  is paid the going public servant's wage,  $w^D$ , regardless of his/her innovative efforts and D captures the entire net social benefit of the innovative activity,  $(1 - \lambda^D) = 1$ . Nevertheless, we expect  $M^D$  to be sufficiently well motivated to volunteer some innovative suggestions to D for

approval. Thus, D maximises the total net surplus of the innovative activity and the corresponding final payoffs are

$$U^D = B^0 - C^0 - w^D + c(e^D) - b(e^D) + \beta(i^D) \quad (\text{for Defence}) \quad (4)$$

$$U^{MD} = w^D - e^D - i^D \quad (\text{for } M^D) \quad (5)$$

From the menu of effort options proposed by  $M^D$ , D chooses the *ex post* desirable (to it) levels of innovative effort  $e^{D*}$  and  $i^{D*}$  by maximising the net benefit of cost and product innovation

$$\max_{e,i} \{c(e^D) - b(e^D) + \beta(i^D) - e^D - i^D\} \quad (6)$$

so that at the social optimum

$$c_e(e^{D*}) - b_e(e^{D*}) = 1, \text{ and} \quad (7)$$

$$\beta_i(i^{D*}) = 1. \quad (8)$$

On the face of it, the first order conditions (7) and (8) are similar to those of the first best case (2) and (3), especially that D chooses the optimum levels of innovative effort by taking into account the expected negative impact of cost saving innovations on quality. The advocates of the IDPO arrangement would argue that when the public-servant  $M^D$  is highly motivated,  $\gamma^D$  and  $\delta K^D$  are high,  $M^D$ 's innovative efforts approach the first best outcomes,  $e^{D*} \rightarrow e^*$  and  $i^{D*} \rightarrow i^*$ . The critics would point out that the outcome depends on the value of  $\gamma^D$  and, thus,  $\delta K^D$ . When  $\gamma^D \rightarrow 0$ ,  $M^D$  may only volunteer the least effort-intensive innovations, so that the optimal efforts  $e^{D*} \rightarrow 0$  and  $i^{D*} \rightarrow 0$ . They are not only considerably smaller than the first best efforts  $e^*$  and  $i^*$  but also likely to be smaller than those produced under the SDPO arrangements, which at least encourage some innovation. It is clearly a matter of empirics to determine the extent to which  $M^D$  is sufficiently well motivated to make effort propose and subsequently implement process and product improvements when his/her wage rate is fixed. Clearly though, such innovative efforts in the in-house model depend on non-wage incentives used to motivate public servants.

The total surplus under the in-house service delivery option is

$$S^D = U^D + U^{MD} = B^0 - C^0 + c(e^D) - b(e^D) + \beta(i^D) - e^D - i^D \quad (9)$$

In the absence of non-wage incentives to innovate,  $M^D$  makes no investment in cost and quality innovation and  $S^D = B^0 - C^0$ . When such incentives are strong,  $M^D$  is well motivated to invest in cost and quality innovation even though the net social benefit of investment efforts  $e$  and  $i$  is captured by D in period 2.

## SDPO

There is renegotiation of the initial contract at the beginning of period 2 even though  $M^S$  has been offered a bonus,  $\lambda^S[c(e^S) - b(e^S) + \beta(i^S)]$  for his/her innovative efforts,  $e^S$  and  $i^S$ , in addition to his/her contract wage  $w^S$ . (D captures the  $(1 - \lambda^S)$  fraction of the net benefit of cost and quality innovation.) While  $M^S$  knows the bonus rate,  $\lambda^S$ , he/she must nevertheless negotiate with D over  $\lambda^S[c(e^S) - b(e^S) + \beta(i^S)]$ , which it cannot appropriate unless D authorises the proposed efforts  $e^S$  and  $i^S$ . Suppose the parties use the Nash bargaining to split the gain 50:50.<sup>xvi</sup> Thus, the SDPO maximises the total net surplus of the innovative activity and the corresponding final payoffs are

$$U^{D/S} = B^0 - C^0 - w^S + (1 - \lambda^S/2) [c(e^S) - b(e^S) + \beta(i^S)] \quad (10)$$

For Defence

$$U^{MS} = w^S + \lambda^S/2 [c(e^S) - b(e^S) + \beta(i^S)] - e^S - i^S \quad (11)$$

for  $M^S$ .

D chooses the *ex post* desirable levels of innovative effort  $e^{S*}$  and  $i^{S*}$  by solving

$$\max_{e,i} \{ \lambda^S/2 [c(e^S) - b(e^S) + \beta(i^S)] - e^S - i^S \} \quad (12)$$

so that at the optimum

$$\lambda^S/2 [c_e(e^{S*}) - b_e(e^{S*})] = 1, \text{ and} \quad (13)$$

$$\lambda^S/2 \beta_i(i^{S*}) = 1. \quad (14)$$

In comparison with the first-best case,  $M^S$  has a weak incentive to innovate as he/she only receives the fraction  $\lambda^S/2$  of the net benefit of his/her innovative efforts. Market competition will also ensure that the public sector bonus is in line with the private sector bonus expectations. And, D may threaten to replace  $M^S$  after he/she reveals good ideas and hire a cheaper substitute (offer a smaller  $\lambda^S$ ) to implement proposed improvements.

The total surplus under the in-house service delivery option is

$$S^S = U^S + U^{MS} = B^0 - C^0 + c(e^S) - b(e^S) + \beta(i^S) - e^S - i^S. \quad (15)$$

Under this option,  $M^S$  is *only* motivated by his/her financial payoff in period 2 (contract wage plus bonus as we assumed  $\gamma^S = 0$ ). The contract wage,  $w^S$ , is used to allocate the surplus  $(B^0 - C^0 - w^S)$  while the division of the innovation-related component of the total surplus,  $\lambda^S$ , must be negotiated by the parties.

### The choice of delivery model

To choose the best service delivery model in period 0, G should maximise the expected total surplus,  $S$ .<sup>xvii</sup> But the only difference between the delivery models pertains to the *ex ante* choice of innovative efforts  $e$  and  $i$ . Therefore, if G succeeds in incorporating high-powered incentives into general terms and conditions of public service employment, high levels of innovative effort might follow.<sup>xviii</sup> Thus, under a very high-powered incentive regime it might be possible for  $S^D \geq S^S$ .<sup>xix</sup> On the other hand, if incentives are poor, we expect the in-house option to be inferior,  $S^S > S^D$ . We revisit these comparisons below.

### DISCUSSION: COMPARISONS OF SERVICE DELIVERY MODELS

The essential differences and tradeoffs between two service delivery options, IDPO and SDPO, are summarised in the form of four propositions:

**Proposition 1** *Under the IDPO model, investment efforts  $e$  and  $i$  appear to be similar to those achieved under the first-best condition. However, this depends on the power of non-wage incentives to innovate. When such incentives are strong,  $e^{D^*} \rightarrow e^*$  and  $i^{D^*} \rightarrow i^*$ , and when they are weak,  $e^{D^*} \rightarrow 0$  and  $i^{D^*} \rightarrow 0$ .*

This is because the IDPO's incentive to innovate largely depends on  $M^D$ 's non-wage incentives to engage in innovative activity, e.g., job satisfaction, empire building, professional reputation. In the absence of such incentives, Defence must use some form of central direction to induce  $M^D$  to be more innovative. On the other hand, public employees may have a strong incentive to innovate if the whole the net gain from their innovative efforts  $e$  and  $i$  is recognised by their employer and used as a basis for promotion and/or enhancement of their reputational capital. This could result in the superiority of high-powered non-wage incentives if the highly-motivated  $M^D$  turns out innovative effort close to that produced by his/her first-best counterpart ( $e^{D^*} \rightarrow e^*$  and  $i^{D^*} \rightarrow i^*$ ) while D also ensures that the detrimental impact of cost innovations on quality is taken into account by  $M^D$ .

**Proposition 2** *Relative to the first-best conditions,  $e$  and  $i$  are both inefficiently low under the SDPO model,  $e^{S^*} < e^*$  and  $i^{S^*} < i^*$ .*

This is because the SDPO manager,  $M^S$ , places less than 100 percent weight on the gains from both types of innovation relative to the weight of 100 percent under the first-best conditions.

**Proposition 3** *When non-wage incentives are weak, the IDPO procurement manager has a weak incentive to innovate so that  $e$  and  $i$  are inefficiently low relative to the first-best case and the SDPO option,  $e^{D^*} \rightarrow 0$  and  $i^{D^*} \rightarrow 0$ ;  $e^{D^*} < e^{S^*} < e^*$ ; and  $i^{D^*} < i^{S^*} < i^*$ , especially when the productivity bonus received by  $M^S$  is relatively large,  $\lambda^S \rightarrow 1$ .*

**Proposition 4** *When non-wage incentives are strong, the IDPO procurement manager has a strong incentive to innovate and the IDPO's investment performance may be superior to that of the SDPO, especially when the productivity bonus received by  $M^S$  is small,  $\lambda^S \rightarrow 0$ , i.e., as  $e^{D^*} \rightarrow e^*$  and  $i^{D^*} \rightarrow i^*$  and  $\lambda^S \rightarrow 0$ ,  $e^{S^*} < e^{D^*}$  and  $i^{S^*} < i^{D^*}$ .*

Thus, comparisons between the SDPO and the IDPO depend on the relative power of non-wage motivational factors. The SDPO must rely on financial incentives,  $w^S$  and  $\lambda^S$ , and when Government consents to Defence paying high productivity bonuses,  $\lambda^S \rightarrow 1$ , so that  $M^S$  is highly-motivated, the innovative effort may be high under the SDPO,  $e^{S^*} \rightarrow e^*$  and  $i^{S^*} \rightarrow i^*$ , even though  $M^S$  only receives a productivity bonus that is a fraction ( $\lambda/2 \rightarrow 1/2$ ) of the net social benefit of innovative activity. On the other hand, the effectiveness of the IDPO depends on whether public servants can be motivated into high levels of effort by non-wage incentives (promotion, honours, and future employability). Thus, it might be possible for the high-powered  $M^D$  to be more strongly motivated to invest in  $e$  and  $i$  than  $M^S$ , who only receives a fraction of the net benefit of his/her innovative activity.<sup>xx</sup>

The evaluation framework developed by Hart *et al* (1997) makes little distinction between activity ownership and its governance. For example, service delivery by private service providers is associated with an excessive tendency to invest in cost innovation and under-investment in quality improvement. This is because in the case of private service provision information is assumed to be distributed asymmetrically so that Defence, as a service buyer, has no direct visibility of cost-cutting efforts of the private provider that impact adversely on service quality and subsequently it has no choice but to accept and “forgive” the resultant quality degradation (Markowski and Wylie, 2010). However, as we noted elsewhere (*Ibid*), any profit maximising service provider, including government-owned trading enterprises, will have a strong incentive to cut costs deeply to produce a surplus for its owners and (surplus-based) bonuses for its managers and employees. These cost cutting efforts may result in product quality degradation which the surplus-maximiser has no incentive to avoid and which may not be visible to the service buyer.

Alternatively, the buyer may not be able to reject degraded deliverables that, given the incompleteness of the initial contract, do not violate the (vague) terms of the initial deal. Also, surplus-seeking public sector suppliers have no incentive to invest in product quality improvement if all expected benefits are captured by the buyer. Thus, non-contractible quality is likely to be a problem when the customer and the provider are separate organisational entities regardless of their mode of ownership (*Ibid*).

The *assumed* unitary decision-making structure under public ownership accounts for much of its apparent informational superiority and managerial effectiveness. Both the IDPO and SDPO models allow Defence complete visibility of M's innovative efforts, e and i, and associated externalities, such as quality degradation resulting from M's cost-cutting activities. However, when the public sector is fragmented with different public agencies free to pursue their own, often conflicting, business objectives, it will be subject to informational asymmetries similar to those attributed by Hart *et al* (1997) to the private mode of service provision (Markowski and Wylie, 2010). In reality, there are likely to be greater informational asymmetries under the SPDO model than under the IDPO arrangement and the organisational detachment of the SDPO from Defence might induce M<sup>S</sup> to engage in some "unauthorized" cost cutting activity that could impact adversely on service quality and which Defence would neither be able to deter *ex ante* nor correct *ex post*. In particular, if the SDPO is allowed to operate as a surplus-maximising (trading) entity, it may behave like the profit-maximising private service provider and engage in excessive cost-saving innovation (*Ibid*).

### CONCLUDING COMMENTS

In this paper, we consider the latest stage in the on-going organisational evolution of the defence procurement function in Australia which has been dominated by calls for an infusion of "commercial" acumen and discipline into Defence procurement arrangements. To this end the debate has focused on the extent of DMO autonomy in matters of financial accountability and employment (see Fitzgibbon, 2009). But the debate has stopped short of making the DMO a government-owned trading agency or privatising it all together.

Our analysis suggests that efforts by the Australian DMO to emulate private sector practice through calls for greater commercial orientation and business acumen are fundamentally misplaced. We argue that bonus-based financial incentives will inevitably be weak in the public sector as only a small fraction of the value of the

innovative effort will be captured by (offered to) employees. Also, why the public sector often attracts ex-private sector employees, it rarely attracts private sector entrepreneurs, who pursue high payoffs and do not wish to be encumbered by bureaucratic constraints. Private enterprise offers more scope for diversifying financial incentives as it allows the private accumulation of non-human assets, such as equity capital, that are transferable between individuals and usually marketable. Thus, simplistic exhortations to defence managers to use commercial style incentives in grappling with public policy problems risks trivializing both public and private endeavours.

Advocates of a more business-like approach do not explain why people involved in commercial procurement activities are better skilled and more disciplined relative to their public sector counterparts. As we note elsewhere, even a small defence power such as Australia has a procurement budget that few domestic private organisations can match. It also acquires technologically-sophisticated products that are beyond the technological (absorption) capacity of most private firms (Markowski and Wylie, 2010). Thus, we argue that the conventional in-house model of service provision need not be less efficient than the pseudo-commercial SDPO provided the IDPO manager is offered appropriate (and traditional) non-wage incentives. The relative merits of alternative service delivery arrangements require quantitative rather than qualitative analysis. Which service delivery option is superior depends on how ownership and management are integrated and rewarded and all such assessments can best be made on a case-by-case basis.

More broadly, our analysis highlights the vacuity of calls for greater commercial orientation and business acumen in the public sector: the essence of the so-called New (Public Sector) Managerialism. Ultimately, the core function of the public sector is to provide public goods and services, that is, those that the private enterprise would normally either under-provide or not provide at all. If the DPO could be operated “commercially” as a government-owned trading agency, thus supplying inherently “private” services, it could just as well be privatised and/or contracted out.

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## NOTES

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<sup>i</sup> Different types of statutory and non-statutory agencies in the Australian public sector are described in APSC (2009).

<sup>ii</sup> This was because, in government's view, "making DMO an Executive Agency as well as a Prescribed Agency would weaken Defence's capacity to conduct operations; undermine the Chief of Defence Force's statutory authority for command of the Australian Defence Force, and the (Defence) Secretary's statutory authority for administration of Defence; entail potentially significant costs to separate DMO from Defence, and in isolation would not achieve a cultural transformation to make DMO more business-like" (Fitzgibbon, 2009: 37).

<sup>iii</sup> It also resembles the 'in-house' public provision arrangements analysed by Hart *et al*, 1997.

<sup>iv</sup> For a discussion of a possible solution is to manage the relationship between the parties so as to enable them to remove the initial contractual incompleteness progressively by learning, collaborating and/or negotiating/re-contracting see Markowski, *et al* (2009: ch. 4).

<sup>v</sup> We also assume that M has no reason to make a positive effort  $e$  to deliberately 'sabotage' the DPO operation, i.e., we expect M to make positive  $e$  with intent to improve cost outcomes in all circumstances. For a discussion of this condition is see Schmidt (1996a: 10-11). Also, a 'contrarian' or indifferent M is always free to set  $e = 0$ . Similarly, we expect positive effort  $i$  to be made with an intent to increase benefit for the service buyer/user.

<sup>vi</sup> Schmidt (1996a) refers to B as a measure of consumer surplus or as 'something that the government cares about'.

<sup>vii</sup> However, G may require the SDPO to pursue a different agenda than that of maximising the expected defence-related benefit of cost and product innovation. For example, it may instruct it to seek cost savings regardless of their potentially adverse impact on quality. It may also instruct it to implement quality innovations which may increase the unit cost of procurement service. In short, G may assign the SDPO objectives that are at variance with those of D.

<sup>viii</sup> All those involved in procurement service decision-making are assumed to be risk-neutral, there is no discounting, and there are no wealth constraints. We also follow Hart *et al* (1997) and make a number of conventional assumptions about the convexity, concavity and monotonicity of  $b$ ,  $c$  and  $\beta$ . These assumptions ensure that the

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optimisation problems have unique solutions under each service delivery option. For a listing and discussion of these assumptions, see Hart *et al* (1997: 1134). In particular, it is assumed that  $c_e - b_e \geq 0$  and  $\beta_i > 0$ , where subscripts are derivatives. That is, the quality degradation due to cost innovation does not offset the achieved cost savings.

<sup>ix</sup> Since initial contracts are incomplete, many such un-authorised changes could be made by M but this raises all sort of questions regarding the expected payoff for M and D's responses to unauthorised innovations that are well beyond the modest scope of this paper.

<sup>x</sup> For example,  $M^D$  may maximise his/her private 'reputational' capital that is related to the level of seniority he/she achieves in the Public Service. This private reputational capital could be converted into private financial capital when  $M^D$  retires from the Public Service to seek more financially rewarding private sector employment. This is the old style Westminster model where a senior civil servant may retire early from the service to take up financially far more lucrative employment in the private sector. In Australia, for example, some Australian federal departments (e.g., Treasury, Finance) are highly regarded and their senior managers and professionals can easily transfer into much better paid positions in the private sector. Similarly, many skills acquired in Defence (e.g., pilots) are highly marketable and command significant wage premia when individuals concerned change jobs.

<sup>xi</sup> The government may also apply to their sense of patriotism and ideological zeal or use coercion and intimidation to force public servants into higher levels of activity.

<sup>xii</sup> Society at large benefits from higher  $\gamma$  as long as the net social benefit of M's innovative effort exceeds its cost [ $c(e) - b(e) + \beta(i) > e + i$ ].

<sup>xiii</sup> To attract  $M^S$ , the SDPO must offer  $(w^S + \text{expected bonus}) = (\text{private wage} + \text{expected bonus})$  with  $(w^S + \text{expected bonus}) > w^D$ . Private sector managers are not be tempted to seek regular public service employment unless adequate wage 'loading' is offered by the government. We use the term "expected bonus" as it includes both a particular dollar value of bonus payment and the probability of achieving it. This varies between sectors. For example, in the private sector bonuses could be high but hard to achieve while under the SDPO arrangement, the bonus payment could be smaller but easier (more likely) to realise.

<sup>xiv</sup> The provision of  $y^0$  is part of  $M^D$  job description.

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<sup>xv</sup> Note that the bonus element of  $M^S$  remuneration is performance-related so that only the bonus rate can be determined *ex ante* in period 0.

<sup>xvi</sup> Alternatively, D bargains with  $M^S$  over the bonus rate in period 0, so that  $\lambda^S/2$  is determined as a default bonus rate.

<sup>xvii</sup> The allocation of the surplus between the parties can always be adjusted *ex post* through lump sum transfers.

<sup>xviii</sup> Such measures cannot be applied locally in the context of the defence procurement function unless it is detached from Defence and restructured as a separate agency operating under different conditions than other public service elements: which is the very point of the proposed restructuring of the Australian DMO into an executive-prescribed statutory agency.

<sup>xix</sup> This would be the case when  $M^D$  is as highly motivated as M under the first best arrangement and there are no information asymmetries about the exact nature of the modified service so that D maximises the total surplus equivalent to the first best surplus. However, even if  $M^D$  is nowhere near as well motivated as M, if non-bonus incentives in the IDPO model are attractive, a well motivated  $M^D$  maybe more likely to innovate than bonus-driven  $M^S$ .

<sup>xx</sup> And whose bonus payments may be more symmetrically related to both success and failure, thus, providing a weak incentive to innovate.