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THE INDUSTRIAL STRUCTURE OF NATIONAL DEFENCE AND TRANSACTION COSTS

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The relationship between National Interests, National Strategy and National Defence strategy is reviewed. The key elements of transaction cost economics are described and a model of National Defence as an integrated set of industries is described. Changes in the transactions cost environment since the collapse of the Soviet Union are analyzed with respect to their effects on the governance structure of National Defence. At each transactional location – final goods, primary inputs, and intermediate goods – the environmental changes are assessed with respect to governance costs. We find that at each location there exist relative reductions in the governance costs of hybrid forms of organization and give examples. The impetus for continued change in the governance structure of the defence sector is certain. These forces have not been appreciated in terms of their interactions with National Interests and National Strategy, suggesting an important feedback loop from the implementation of Defence Strategy to National Interests.

Keywords: National interests; Strategy; Transaction costs; Environmental changes

INTRODUCTION

The Department of National Defence is, in effect, a multi-product corporation serving the diverse needs of the Canadian Armed Forces. This 'corporation' is notable for being highly vertically and horizontally integrated; it produces its own intermediate goods (personnel training and capital maintenance and enhancement) and support services (financial, legal, health, and management) to land, sea, and air divisions. The view taken here is that DND, as a highly integrated firm, is being buffeted by changes in the transactions cost environment and, as a result, is being forced to consider changing its governance structure. Our analysis suggests restraint in any proposed shift from hierarchal to hybrid governance.

The structure of the paper is as follows. The next section discusses the relationship between National Interests and the demand for National Defence output and traces the linkages through to Defence planning and resource allocation. The subsequent section discusses the analytical framework of transactions cost economics and a model of DND as a firm. This model characterizes DND as a set of potential industries producing intermediate and final services of

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personnel training and capital that identifies the location of implicit transactions that can be opened to analysis. The fourth section examines the transactions of the firm and suggests that the hierarchical governance structure of DND is shifting towards more hybrid forms at each transactional location. The final section concludes.

NATIONAL INTERESTS, NATIONAL STRATEGY, AND NATIONAL DEFENCE OUTPUT

The objective underlying any defence planning system is to help make coherent choices for the future.[1] The typical framework used to analyse the relationship between National Interests and National Military strategy posits a top down structure in which National Interests give rise to national strategies, including foreign affairs strategy and national security as well as domestic economic strategy Military or National Defence strategy is then derived from the set of National Strategies.[2] The choices necessary to support the national defence strategy guide resource allocation with respect to defence planning and force development.

In this broad view, there is no feedback effect from the allocation of defence resources to National Interests. At best, feedback effects may have been considered in the evaluation of National Interests. For example, the forbearance of nuclear weapons for the furtherance of Foreign Policy implies that defence planning will not include the acquisition of nuclear weapons.

National Defence Strategy would identify alternative approaches to securing vital interests as well as strategic trade-offs. Figure 1 depicts one way of considering this type of strategic trade-off. It employs judgements about the probability of occurrence and the degree of danger a particular threat poses to the nation.[3]

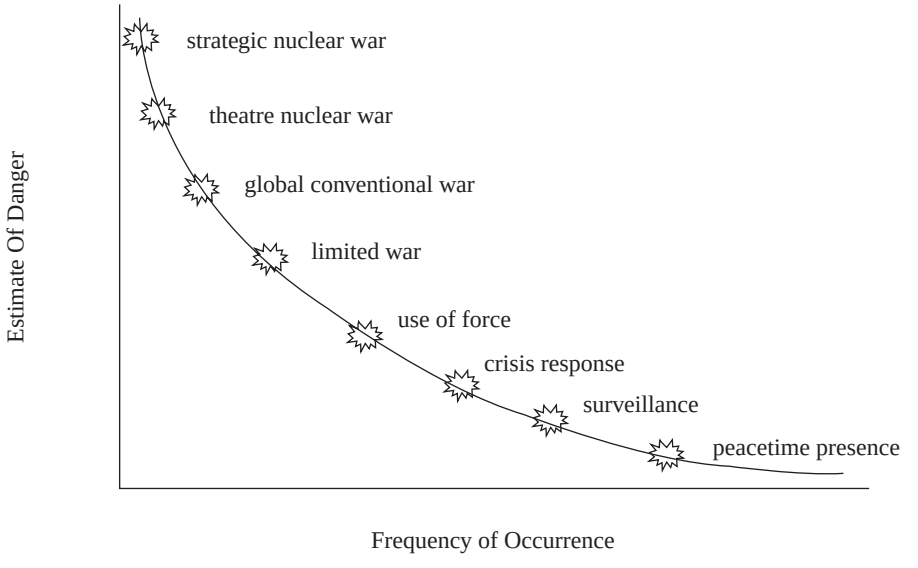

FIGURE 1 Force planning cases – probabilities and dangers.

[1] For a recent discussion see Robertson (2003).
[2] See for example, Lloyd (2000), Nuechterlein (2001) and Bartlett *et al.* (2000).
[3] This portrayal was originally employed by General (USA ret'd) Maxwell D Talyor, and was adapted by Bartlett *et al.* (2000).

In this framework, danger is the potential for harm to the Nation's interests. With the collapse of the Soviet Union, the probabilities of the three most dangerous contingencies were greatly reduced; possibly to zero for Canadian strategic planning purposes Resources could clearly be reallocated to contingencies that required different military responsiveness and capabilities. Associated with the left-hand side, would be extensive use of combat operations on an infrequent basis. As one moves towards the right, contingencies become more frequent but combat operations become less extensive. Many operations call for a mixture of military and non-military tools such as economic sanctions, foreign development assistance, policing, training, emergency aid and humanitarian assistance that are not core military functions.

The shift from the left to the right in terms of dangers faced, changes the defence transactions environment and hence the choices relevant to the governance structure of National Defence. For most nations, this mention of transactions costs would suggest the considerable influence on defence procurement decisions imposed by political constraints. In the context of this analysis, those constraints can be viewed as stemming from domestic economic strategy and policies designed in the National Interest. Trade, regional distribution of benefits, employment patterns and industrial support are goals of domestic strategy, and defence procurement is often subject to review and conditions imposed by agencies other than national defence agencies. The fundamental conflicts that arise between defence and non-defence agencies generate a wide array of transactions costs. These are not addressed directly in this study[4] but a theme of the analysis is that the reduction of transactions costs in defence procurement implies a re-consideration of the conflict between national economic strategy and defence procurement strategy.

TRANSACTIONS COST ECONOMICS AND NATIONAL DEFENCE

While Coase (1937) is credited for focusing on transactions as the key unit of analysis in the economics of the firm, Oliver Williamson has further developed the notions and has produced an operational framework for the analysis of the choice of governance mechanism.[5]

Transaction costs include ex-ante search costs of finding the market, and identifying traders. In spot markets (competitive markets, instantaneous trade, anonymous agents) these cost are relatively low. With even simple trades complexities arise; even warranties require contracts. Transaction costs include the cost of designing and negotiating contracts. More importantly, costs also include the ex-post implementation of contracts through to completion, including monitoring, enforcement and settlement of disputes. It is presumed that the transactions will be repeated so that some costs that might occur in a once only exchange (negotiation for example) might also be important in future contracts.

In the TCE framework, governance structure is a choice. This is not equivalent to designing an optimal contract. For example, for some hazards of uncertainty, insurance can be purchased in the form of a contract that specifies how particular contingencies will be mediated and concluded. Alternatively, parties might agree, by contract, on methods of measurement, information sharing and dispute resolution. This relational contract binds parties to a degree of cooperation and coordination and removes the scope for costly uncoordinated autonomous actions that would otherwise be available to the firms.

[4] An thorough economic analysis of these types of costs due to national economic policies is given in Markowski and Hall (2004).

[5] A number of Williamson's collected papers appear in his books (Williamson, 1975, 1996). Citations to these articles will be to the text and chapter of the relevant book.

The combination of bounded rationality and uncertainty or complexity gives rise to transaction costs. The greater the uncertainties and the more complex the transaction the more imposing are the limits on rationality (complete contracts are impossible) and hence the greater the chance of costly adjustments. These anticipated transactions costs provide the incentive for designing relational contracts that specify internalized and coordinated processes to remedy hazards jointly.

Investment in specific or unique assets can give rise to strategic behavior in small number bargaining. What starts out as large numbers contracting may turn into small numbers contracting ex-post due to the relation-specific investment. The result is small numbers bargaining with strategic behavior to capture the quasi rent – the hold-up problem.[6] It is the combination of opportunism and small numbers that leads to increased transactions costs. Opportunism of agents implies that more complex contracts are required, renegotiation time and costs may increase, and economic resources may be allocated to capturing rent. Such opportunism may also arise from informational asymmetry ('informational impactedness', Williamson, 1975: Ch. 2). In particular, firms that obtain a first contract may have identical information to all other providers, but ex-post they gain informational advantages over competitors through experience with asset-specific processes, which they can use to strategic advantage in future contracts. Information is a source of quasi rent 'and common ownership is often the device by which concerns over asset dissipation are mitigated'.[7]

Types of asset specificity that give rise to quasi rents include physical capital, human capital, location, brand name capital, dedicated assets and temporal specificity (timely response of on-site human capital).[8] To this we add intangible assets, which includes process specificity (allowing a firm to conceive of task requirements and to create efficient standard operating procedures) and individual expertise specificity (involved in resolving ambiguities in task planning and execution).[9]

Bounded rationality with complexity, opportunism with small numbers and informational asymmetries are associated with increased transactions hazards and costs, which make alternative governance structures economically feasible.

A Heuristic Model of TCE and Governance Structure

The fundamental premise of TCE is that governance structure is an economic decision based upon the transactions hazards that present themselves. A trade-off is made between the uncovered hazards of repeated exchanges and the attenuation of incentives implicit in relation-specific contracts (or integration) designed to reduce hazards. While the model of bilateral dependency addresses issues related to vertical integration, there are also bilateral structures that do not lead to full integration over the long run. These 'hybrid' structures (Williamson, 1991) include a broad range of governance mechanisms between (or among) autonomous agents.[10] They are characterized by long-run contractual arrangements that delineate the relationship-specific adjustments and adaptations that will be made in response to unforeseen events. These contracts go beyond the quality, quantity, and timing of

[6] The transformation from a large numbers to a small numbers problem is called the 'Fundamental Transformation' by Williamson (1996: Ch. 3). See also Church and Ware (2000: Ch. 3) for examples of the hold-up problem.

[7] Williamson (1996: Ch. 3, p. 65).

[8] Williamson (1996: Ch. 4, p. 105).

[9] Subramani and Henderson (1999) construct a model using specificity of intangible assets along the dimensions of process and expertise specificity. It applies generally in the delivery of combinations of services, which are customized to meet individual customer needs. The quasi rents are a product of the customization.

[10] Hybrids would include distributorships, franchises, as well as various inter-firm arrangements. For a review of alternate networks, see Grandori and Soda *et al.* (1995).

exchanges to incorporate information sharing, dispute resolution procedures, and rent sharing processes. The hybrid form of governance requires a degree of cooperation and coordination rather than individual adaptation in response to shocks.[11] The heuristic model of governance structure is based on the differential transactions cost of each form.

In this model, there are two elements to the cost function, the level of output and the degree of capital specificity. For a given degree of asset specificity, denoted k, the cost function is convex in output. Asset specificity can be increased at constant cost and confers a cost advantage for each level of output, but each level of capital specificity also implies differential governance costs. For a given level of output, governance costs are a convex function of the degree of asset specificity. The governance costs for an autonomous firm using low levels of k are low since expected costs of unrelieved hazards are low and the investment in such capital has many alternatives. For higher levels of k, the expected costs of hazards increase at an increasing rate. A governance structure that is designed to relieve hazards is more costly (administratively and in terms of attenuated incentives) than an autonomous firm at low levels of k and these costs increase (convex) as k increases. However, such a governance structure reduces the expected costs of hazards more than that for an autonomous firm as k increases (since no hazards are covered). The optimization problem for a firm can be expressed as:[12]

$$\text{Max } \pi = R(X) - C(X,k) - ak - G^i(k) \tag{1}$$

where profit maximization is with respect to output X and capital specificity k. The term ak represents the linear costs of increasing capital specificity and the function $G^i(k)$ represents governance costs of form i Capital specificity and output are jointly determined for a given governance structure. Profit maximization requires a comparison of maximum profits over all governance types. Since the profit function differs across governance types in the governance costs only, a graphical comparison of cost with respect to asset specificity can be used to expose the alignment of transactions cost to governance structure.

There are two extreme types of firm organization, market (with $G^{\mathrm{m}}(k)$) and hierarchy (with $G^{\mathrm{h}}(k)$). The former does not rely on relational contracts to overcome contract hazards and the latter internalizes all transaction hazards. As noted above, it is expected that $G^{\mathrm{m}}(0) < G^{\mathrm{h}}(0)$ and $\mathrm{d}G^{\mathrm{m}}(k)/\mathrm{d}k > \mathrm{d}G^{\mathrm{h}}(k)/\mathrm{d}k$. The hybrid forms of governance (with $G^x(k)$) are presumed to be intermediate such that $G^{\mathrm{m}}(0) < G^x(0) < G^{\mathrm{h}}(0)$ and $\mathrm{d}G^{\mathrm{m}}(k)/\mathrm{d}k > \mathrm{d}G^x(k)/\mathrm{d}k > \mathrm{d}G^{\mathrm{h}}(k)/\mathrm{d}k$. Figure 2 illustrates the case with only one hybrid.[13]

Note that hybrids may have governance costs that are everywhere higher than the market or hierarchy, but they would be dominated in profits by the latter two forms. The governance cost curve for the hybrid form can also be thought of as the envelope of cost curves for different hybrid types, each of which is a profit maximizing type for a particular level of asset specificity and the greater the asset specificity, the greater the role of relational contracting.

The forgoing leaves out variables that might be sources of shocks, in particular shocks to the governance-cost expressions. It is more useful to consider reduced form expressions of the form:

$$G^j = G^j(k;s) \tag{2}$$

[11] See Menard (2002) for a discussion of hybrid organizations and their empirical regularities.

[12] What follows is a simplified form of Williamson (1996: Ch. 3 and Ch. 4). See also Riordian and Williamson (1985) for a more formal treatment and extension that includes economies of scale and scope.

[13] The figure is due to Williamson (1996: Ch. 4, p. 108).

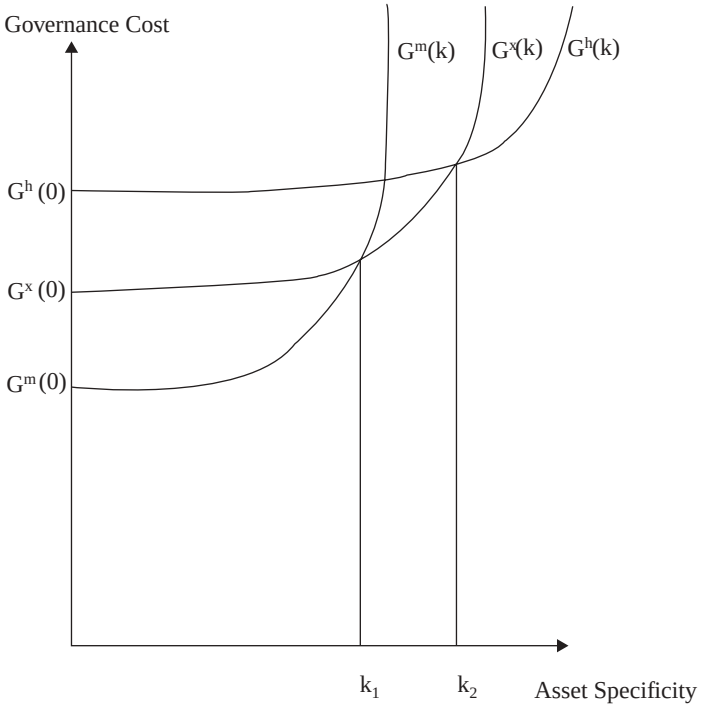

FIGURE 2 Governance choice.
For any level of output, governance costs increase with asset specificity. At very low levels of asset specificity, hazards are small and organizational costs rise with hazard protections put in place.

where *s* is a vector of shift parameters. These parameters change the institutional environments that affect the expected value of the hazards in transactions Williamson (1996: Ch 4) examines four parameters; property rights, contract law, reputation effects, and uncertainty.

Property rights are weakened when expropriation becomes more probable. In particular, leakage[14] of the quasi rents associated with knowledge and information occurs when it cannot be lawfully protected. Leakage gives rise to forward integration into subsequent stages of production to protect the quasi rents. Greater leakage in the environment would imply greater hazards for market and hybrid organizations relative to hierarchy. In Figure 2, the points k_1 and k_2 would shift left. Thus, the greater the risk of losing the quasi rents of specific factors through leakage the greater the impetus to form relational contracts to preserve rents. Some firms would switch from market to hybrid and others would switch from hybrid to hierarchy.

Contracts are not always easily enforceable due to general measurement problems, such as quality monitoring or level of service. Trust between and among traders can substitute for some complexities of contracting. In this setting, reputation effects become important. A network of traders, which places importance on reputation, tends to constrain the opportunistic behavior of individual traders and thus reduces the hazards and governance costs associated with hybrid forms. In terms of Figure 2, k_2 would shift right and some firms would find it economically beneficial to move from hierarchy to hybrid form.

[14] Williamson (1996: Ch. 4, p. 114) uses the term leakage to describe weaker appropriability of quasi-rents attached to knowledge and information.

Uncertainty in the TCE context refers to the frequency of hazards or the cost of adapting to the hazard. An increased frequency of hazards is more costly for hybrid forms since the dispute resolution mechanisms must be in play more frequently. Moreover, if the disturbances tend to be generally of the type where autonomous actions are efficient then market forms become relatively more efficient. Alternatively, where coordination of actions is more efficient, a move to hierarchy might be most efficient. Thus, increases in the frequency of hazards tend to increase the governance costs of the hybrid form relative to market and hierarchy. In Figure 2, k_1 would shift right and k_2 would shift left; hybrids are squeezed out.

Transactions in National Defence

The usual difficulty in the analysis of National Defence is the measurement of the value of output. National Defence provides the public good of deterrence from attack. It also produces military support to United Nations programs, military support to alliances and aid to civilian authorities. Each of these goods can also be considered as public goods to the extent that they are in the 'National Interest'. (Aid to domestic civilian authorities benefits specific individuals in many cases, but it can also be viewed as an insurance policy for all citizens.) Each of these output goods requires a mix of human and capital resources from the pool of National Defence resources. The value of the defence good produced to the demander may not be directly measurable (the value of the public good), but the physical quantities of the outputs from National Defence can be measured. Moreover, the same outputs from the DND industry can produce different final National Defence goods to the demander (a given set of troops and equipment can guard a border checkpoint for NATO or deliver humanitarian aid for the UN).

Making the distinction between final output of the DND and National Defence goods allows the use of an input–output framework in the analysis of the transactions within the defence sector as separate from the value or specific definition of output in consumption. The final output of National Defence, viewed as a multi-output firm, is a set of persons and equipment. National Defence goods are the uses or tasks that can be assigned to the final output.

A natural measure of industry output for DND is an inventory of operationally ready resources; individuals and equipment on active operations and those available for operations. A related feature of DND is that a significant portion of total resources is allocated to intermediate inputs undergoing value added processing of some kind. For personnel, there is an extensive service sector providing training and educational services. Similarly, there is a 'manufacturing' sector in which capital as an intermediate good is processed into an operational unit of equipment.

A disaggregated input–output structure of DND consists of intermediate services of personnel training and capital services in three dimensions; rank, element, and training type. Ranks include private, corporal, warrant officer, master warrant officer, junior officer and senior officer. Elements include land, sea and air. Training type is determined by the nature of the intermediate value added, which includes both military on-the-job training as well as technical or classroom training. Capital services include repair and upgrading of capital for the land, sea and air elements. The final outputs are personnel at each rank and element ready for operational duties and the equipment ready for operational duty in each element. An important feature of defence final outputs is that they are an inventory, various parts of which can be selected for particular purposes. In relatively peaceful periods, operationally ready assets may be generally engaged in various exercises with or with out allies.

The Input–Output structure is hypothetical for the present purposes. It describes a set of potential industries that provide intermediate goods and services, final goods and services, and the main primary inputs to these industries that together have been vertically and horizontally integrated into the Department of National Defence Analytically, it is used to locate transactions

and the characteristics of these transactions that may give rise to changes in the governance structure.

GOVERNANCE STRUCTURE AND NATIONAL DEFENCE

The main thrust of the analysis is to show that, at least comparatively, changes in the transactions cost environment have reduced the governance costs of market and hybrid forms relative to the hierarchical form of National Defence. With respect to final outputs, we suggest that the requirement for a particular facet of military human capital specificity has been reduced and that the requirement for timeliness of delivery of final outputs has been diminished. With respect to the intermediate services (human capital acquisition) we suggest that a bifurcation between military and technical training is occurring as well as a reduction in the specificity of training capital. With respect to the primary inputs to each sub-industry, we suggest that technological innovation has given rise to a high degree of specificity of intangible assets. Hybrid forms reduce the expected costs of hazards relative to market forms, but retain the innovativeness and expertise specificity not generally found in a hierarchy.

The important distinction between military and non-military human capital (and physical capital) is the extent that they are put in harm's way.

In Harm's Way

The most important asset specificity of defence forces is the probability of death and injury to humans and destruction of capital. The internalized dispute resolution mechanism specific to military personnel includes a justice system parallel to the national justice system in which individuals can be jailed for non-performance of duties. Even minor civilian offences, such as drunkenness and other actions that would be to the prejudice of good order and discipline, can result in serious disciplinary action. Until recently, the death penalty could be meted out for extreme cases of desertion on the battlefield. The harsher aspects of the military justice system evolved in response to the hold-up problem; military personnel do not have the option of quitting in the face of grave personal danger. Military personnel can be put in harm's way and they must be able to respond to some situations with lethal force.

Capital goods that are in harm's way and subject to the possibility of total loss can also generate a hold-up problem. While the buy or sell decision is the framework for the market versus hierarchy analysis, various forms of leasing can be associated with hybrid organization. The transactions cost associated with leasing equipment increases as the probability of being put in harm's way increases. Even if insurance contracts can be implemented, transaction hazards continue to exist in the form of moral hazard and hold-up (the extent to which the capital is more highly valued by Defence than by the supplier creates quasi-rent). Where the probability of capital loss is sufficiently high, the cost of leasing plus transactions costs must be larger than the cost of buying or making.[15]

Final Goods and Services

We consider first the final goods and services. During the Cold War, National Grand Strategy directed defence forces to be ready for the highest level of danger. With respect to Figure 1 (Force Planning), Military Strategy was directed towards nuclear war and global conventional

[15] Williamson (1996: Ch. 4) discusses uncertainty Higher probabilities of outliers (transaction hazards) reduce the efficacy of hybrid forms.

war. The inventory of operational force assets were strategically located, were readied for timely response, and stressed interoperability with allied forces Supply management was directed towards intense operations (land, sea and air) National Defence was prepared for in harm's way conditions. Location specificity, timeliness, and human and physical capital specificity (in harm's way) were dominant features of the Defence final goods. The design of military forces was directed towards high intensity combat operations. The cost of any hold-up through opportunism, combined with an uncertain timing for requirements for goods and services from a private supplier, is high and a high degree of hierarchical governance would be consistent with such an environment.

The euphoria attached to the collapse of the Soviet Union reflects the extent to which the probability of threat of a nuclear war or global conventional war was diminished. Whether by design or luck, the past 15 years of military interventions have been concentrated on limited war or less dangerous contingencies. The extent to which defence planning has incorporated this shift into the design of military forces is a subject of continuing discussion, but the transactions environment for final goods and services has changed.

Massive force asset location in Western Europe is no longer required. Allied forces and UN sponsored forces have been deployed to the Mid-East, Africa and Eastern Europe. These responses are on an as-required basis and are not meant to be permanent establishments. The timelines for responding to incidents has also been relaxed. The major conflicts in the Balkans and Iraq were characterized by relatively long ramp-up periods; periods of many months rather than the hours, days or weeks for planned responses to Soviet aggression.

The more limited the conflict, the less are the costs of hold-up hazard associated with being in harm's way. Part of the final goods inventory of personnel and capital is the sea and airlift capability. Military air and sea transport are required if there is a real transit threat. Absent the threat, commercial air and sealift for passenger and freight might be utilized without entering a dangerous area that reduces the rents associated with potential hold-up. Leasing or renting in the spot market or arranging longer-term leasing or retainer contracts with commercial firms becomes a feasible tool for the reduction of inventory costs of maintaining a large and ready air and sealift capability. The inventory management problem can be turned over to the market that services many such customers. These hybrid forms of governance become feasible to DND because the potential rents (the cost to National Interests) to be sought by opportunistic behavior are attenuated.

Logistical planning, which includes a role for commercial lift capabilities has been in place in the US Department of Defense for some time.[16] Leasing of commercial air and sealift capabilities has also been discussed in the Department of National Defence.[17] Aside from using a spot market in lift services (which present their own hazards), other leasing proposals that have been discussed within DND include equipment purchases by DND, which can be leased to other parties or long-term retainer contracts and which would specify maximum usage over a given period.

A potential advantage of the hybrid form relative to hierarchy accrues to the extent that new technologies in the private sector are more quickly incorporated into newer capital due to competitive pressures. Finally, the military labour inventory associated with lift capacity can be reduced if the contracts also include the requisite crews. The rents associated with a labour hold-up are greatly reduced when labour is not in harm's way and the potential cost to national

[16] United States, Department of Defense (1996: Ch. 21, Mobility Forces). See also Bence (2000) for a more detailed analysis of the role of commercial airlift. Jackson (2003) reports on prepositioning support for the 2003 War on Iraq.

[17] Canada, Department of National Defence (2001).

Interests is reduced; exactly those changes that occurred from the Cold War era to the post Cold War era.

The transaction cost environment associated with the combat capability is also changed significantly, with the reduction in the level of danger. With limited war, more choices are presented over the size and nature of the military contribution, but the danger to combatants militates against hybrid organizations.[18] Contingencies with less danger to the individual attached (crisis response, surveillance, peacetime presence) may well reduce the need for highly trained military combatants. These national interests still require a degree of human and capital specificity (organization, deployment capability, limited combat equipment), but there are more substitutes available, which is consistent with the reduced human capital specificity. Substitutes include financing military support from other countries (as in some UN sponsored missions) as well as commercial contracts for support services.[19] These hybrid forms of organization have become feasible as the probability and consequence of supplier hold-up are reduced. These hazard reductions stem from reduced level of danger to individuals and equipment and allow for different governance systems as well as reduced inventory levels of combatant personnel and equipment.[20]

The transaction environment changed from high danger to medium or low danger with the collapse of the Soviet Union. The delivery of final goods and services has been opened to the possibility of hybrid forms of governance in which private commercial firms could economically provide end products on an ongoing longer-term basis. However, many types of long-term service contracts are not currently permitted in national procurement guidelines. The rationale for restrictions on types of contracts flows from different components of National Interests, domestic economic and financial policies. Are National Procurement policies to be relaxed for DND procurement? Does a Military Strategy that leans heavily on commercial support risk a catastrophic reduction in capability due to competition for required services. In particular, a significant hold-up (transaction cost) could be incurred if many nations follow a similar hybrid procurement strategy and, as allies, all are faced with a limited war.

Intermediate Goods Industries – Primary Inputs

The implicit intermediate goods industries have as primary inputs civilian labour, military labour, supplies (materiel) and capital. While alternative service delivery (ASD) has garnered headlines in the popular press it has done so primarily in the context of contracting-out military base support services that were being supplied internally by civilian labour. There is nothing in the transactions environment that would give rise to a change in the cost of governance between hybrid and hierarchy in this case. Rather, in a search to reduce costs, an examination over alternative structures was conducted. A general rule of thumb has emerged from these costing exercises; if internal organization can reduce costs by 30% then the service will remain

[18] There has been considerable use of Private Military Companies but we consider these to be in a legal 'grey' area. See Avant (1999), Markuson (1999) Shearer (1998). For an economic discussion of public versus private force see Brauer (1999).

[19] Frontec (www.atcofrontec.com) 'In June 2000 the Department of National Defence (DND) awarded Frontec a two-year contract to provide support services for peacekeeping installations in Bosnia-Herzegovina. The award is the first time in recent history that the Canadian military has employed full-support service contractors in deployed operations and has resulted in the birth of a new Canadian industry – deployment support services.' Other main suppliers of support services are cited in the references of the previous footnote.

[20] It should also be noted that as combatant forces have become experienced in limited war, they have become more specialized for that environment; Special Operations Forces on the US and JTF2 forces in Canada are examples. This new specificity includes a higher degree of integration (personnel from different elements and with different military skills) and interoperabitity (the ability to operate ever more closely with allies).

internal to the organization. Thus, periodic threats of open bidding may be sufficient to reduce some of the bureaucratic cost of hierarchical structures.

Material

That innovation in the field of information and communications technologies (ICT) has transformed the business community is accepted. Firms are 'flatter', they spin off 'non-core' activities and enter into various arrangements for the supply of required services; clearly, a move from internal provision to hybrid provision. Of note however, is that the TCE view of these changes is that the ICT environment has given rise to firms with particular expertise in complex and timely coordination of numerous activities.[21] Supply chain management and 'Just in Time' inventories are the prime examples of what Subramani and Henderson (1999) call the specificity attached to intangibles. Firms specializing in supply chain management have superior knowledge (through experience and relationships with other customers) about specific processes and have individuals with specific knowledge to customize processes for novel or unique customer demands.[22] The hierarchical form of governance is limited in its customers, and as a consequence less likely to be innovating on an ongoing basis and it may not be able to avail itself of economies of scale and scope as might be expected of specialist firms. In such hybrid forms, there may be many firms involved (hence some references to networks of firms) which require information flows as well as expertise flows.

From a transactions costs perspective there has been extreme leakage. Specialist firms have more information and expertise than the hierarchy. The pressures to enter into hybrid organization for supply chain management are not new in the public sector and authorities in most industrialized countries appreciate the force of the proposition. It has also been very much discussed in Canada in the Department of National Defence (Poter, 1999), but little appears to be changing. In this case, a move from hierarchy to hybrid forms for supply chain management may impinge upon the domain of Public Works Canada and indirectly upon the financial and economic policies of the Government of Canada.

Capital

Major capital procurement projects have been a concern for public policy, economic policy, social policy, and competition policy as well as defence planning policy. The problem of small numbers and asymmetric information in capital procurement has been a focal point of defence policy in most Western countries. Procurement policy generally requires a tendering process, a request for proposals, and a statement of technical specifications. Deliverables are strictly defined and the procuring department ensures compliance. Defence procurement is typically small numbers exchange with considerable investment in dedicated assets or specific capital being required. In addition, there has often been a degree of development required that tends to lead to altered specifications and costly contract renegotiation. Each of the parties is concerned about their own outcomes and the relationship between contracting parties ends with delivery of the specified goods. Market contracts for military platforms and weapons systems are characterized by considerable hazards due to uncertainties in the final project deliverables as well as the large investment in dedicated assets. Note that in the case of capital

[21] New technologies that reduce production costs only and have no effect on governance costs will have no effect on the choice of governance structure.

[22] Networks of firms are also a hybrid structure, see Grandori and Soda (1995). For a more complete discussion of the importance of information and firm boundaries see Dubois (1998). Bender (2002) investigates empirically the impact ICT dissemination internationally. Cautions against privatizing and out-sourcing include Sclar (2000) and Schwartzwaelder (2001).

procurement, DND is simply a market player; it buys in the market rather than producing the good internally. A move to a hybrid form of governance implies a move from the market to hierarchy.

Innovations in technologies are at the heart of the discussions about the Revolution in Military Affairs. The increased technical complexity of many projects now requires greater cooperation and exchange of information between the contracting parties. The implied transactional hazards associated with complexities and asymmetric information can be mitigated by relational contracts. Hybrid governance structures provide for a longer-term relationship over multiple contract periods in which the parties have 'joint activities that enables the ongoing negotiation and modification of activities in response to circumstances as they arise'.[23] In principle, the parties engage in an ongoing relationship. Long-term leases are a step in this direction (the UK and the US have considerable experience in such arrangements), as are life cycle contracts. Indeed, a draft Request for Proposal for the Maritime Helicopter Program[24] included details on the requirements for the commercial contractors to provide maintenance, technical information services, and training over the life cycle of the project.

Leasing and life cycle contracting both imply a greater role for the commercial sector in providing Defence capital. Some of the services produced by the intermediate industries providing capital services may be eliminated with these types of contracts and may have consequences for military and civilian staffing. (These personnel changes are not necessarily savings of a move from market to hybrid.) Poter (1999) refers to these methods of procurement so that it is clear that they have received attention in DND and the Government of Canada.

To the extent that capital procurement involves hybrid forms of organization, it may also have implications for other National Strategies similar to those noted for supply chain management. In addition, some hybrid forms may not be appropriate for some types of purchases that require approval by foreign powers. Some types of aircraft and some leading edge technologies may only be purchased on a government to government basis.

New technologies have been incorporated into simulators for various types of vehicles and weapons systems, which present themselves as substitutes for operational capital when used for training. The case for hybrid governance is much weaker in these settings since maintenance and training are often performed internally by design and intent. Market contracts can also be made for time used in commercial facilities if required. The environmental factors of timeliness and harm's way do not apply to capital for training purposes.

Labour

The primary labour inputs to the intermediate industries include military and civilian labour tasked with simple support services, supply chain services and training. The first two categories have been discussed above and we consider only the labour used in training. We distinguish two types of training, military and technical. Technical training refers to that which could be provided commercially through technical school, Community Colleges and Universities. We suggest that military training involves elements that military trainers can best provide: ethos, espirit de corp, military team effort, organization, discipline and military leadership. Some technical training might well be provided by commercial entities, the governance structure of the civilian labour force (dominated by public sector unions) is unlikely to be affected by a greater or lesser demand for services.

[23] Subramani and Henderson (1999: 4).
[24] www.dnd.ca/admmat/mhp/ssi.

Intermediate Goods

The intermediate goods in this framework differ from standard input–output tables in that the output from one stage does not typically flow directly to the next stage. Training at one level is typically followed by an operational assignment, and then, typically, to a primary input assignment (support function or training function). At each stage, the individual acquires more specific human capital. It is possible for an individual to enter the Forces with technical training and to move to an appropriate rank quickly. (Some Community College technician courses can allow a new recruit to be promoted to corporal on completion of Basic Training.)

The fact that an individual gains more human capital as training progresses revives the hold-up problem by increasing the returns available in the civilian market. While there has been recognition of this effect and it is reflected in salaries differentials for some specializations (Pilots, Lawyers, Doctors, some technical trades), the issue may become more prevalent as ICT and other technical trades require enhanced human capital.

Where the private sector provides equivalent training, the cost of training is borne by the individual and is considered a private investment in human capital. This training, when provided by the hierarchy is at public expense, which leaves economic rent to the individual. Labour defection increases the cost of the training hierarchy. An alternative hybrid form of organization, relationships with Community Colleges or commercial providers over certain types of programs, may present themselves as less costly alternatives. This approach implies that an intermediate good, a highly technically trained individual, could be 'purchased' and militarily trained, which would avoid the cost of the internal training that would span a number of cycles (training, operations, support function).

The TCE argument for a hierarchy in the production of intermediate goods (training) rests on the highly specialized military value added. However, due to the Revolution in Military Affairs, there is an increasing demand for non-military human capital assets for which there exist well-developed markets. Thus, a prediction of this approach is that there will be some degree of bifurcation between military personnel and civilian personnel fulfilling military roles with the latter having relatively little traditional military training and being 'purchased' in the broader labour market.

A second change in the transaction cost environment is the reduction in danger to National Interests and consequent shift to limited war or less. As noted, there may be a shift towards smaller highly militarily trained squads. Excellence in specific military skills may not be strongly related to military rank, but it does suggest that further changes to the pay structure as well as the design of the training structure may have to be considered. The TCE approach would suggest that the increase in required human capital specificity would ensure continued production in the hierarchical governance form. However, the cost associated with such specialization could lead to a special case of hybrid organization: the cooperation of rivals. Specialist training with the forces of other countries is a hybrid training system.

In general, exchanges among rivals may be viewed as anti-competitive (which is not a concern among allied National Forces) and is considered an anomaly if carried out in the long-run. There are conditions under which such arrangements do make economic sense.[25] First, there must be potential scale economies (the source of cost reductions) in relation to the market. The cost reductions can only be realized through dedicated assets. Second, reputations must extend beyond the local market (the value of the product sold by the rival must be greater than that sold by local suppliers). Canada has a reputation for a well-trained and professional military that excels in numerous specializations. Some Canadian training bases are well suited for particular types of training and have recognized expertise in training (dedicated assets). It

[25] See Williamson (1996: Ch. 5, p. 134–137) for a discussion of reciprocity.

is irrelevant whether cost reductions stem from the excellence of the training staff or by increasing the rate of throughput of trainees. Enhanced interoperability with cooperating allies is also a side benefit to training exchanges.

Hybrid organization of this sort clearly has implications for National Interests. Increased integration and military cooperation can be viewed either positively or negatively, whether it is viewed as promoting alliance strengthening or weakening national independence. This represents a feed-back from the governance structure of defence resources to National Interests.

It should be noted that the existence of commercial contracts are not evidence of a change in governance structure from hierarchy to hybrid. A training system has a flow rate of trainees. Some peak variations in flows that are accommodated by commercial contracts do not change the underlying structure of internal provision. Likewise, sending members to commercial training for some specific courses is not hybrid governance unless the contracts call for cooperation and coordination over an extended period.

Aggregate Labour

We have described changes in the local transactions environment for labour used as final goods, intermediate goods and primary inputs. Here, we consider the aggregate relationship between labour of the military forces and the DND firm. The hierarchical structure exists because under some conditions one side can extract rent for the other side; the firm may shirk on employment and remuneration when labour is less required, labour can hold-up for increased benefits when most urgently required. Hierarchy commits the parties to internalized long-term contracts. The inventory flow of final goods and services has low variability and changes in the flow can be easily accommodated.

Significant changes to the employment contract have been observed over time without significantly changing the transactions cost environment. Human rights legislation has applied equally to the Canadian Forces as an employer; there is to be no discrimination by race, colour, sex or sexual preference. Many of these developments occurred before the collapse of the Soviet Union.

Prior to the collapse, labour enjoyed rent in the form of an almost guaranteed progressive career path based on merit, a path of salary and benefits which paid a premium over alternative paths, and an attractive pension plan. That this rent could be extracted is due to the high probability of lethal damage that the individual could be expected to incur in the event of hostilities. The employer received a considerable share of rent in the form of peace rather than incredibly costly national or world conflict. The hierarchy shared the rent.

The collapse dramatically changed the rents to be shared; the survival risk to the nation state and the world was reduced to something much closer to zero. The rationale for a large standing military force gave way to smaller forces, but it is not the scale of output that determines the transactions environment. The reduction by 25% of the personnel of the Canadian Forces was achieved by breaching the implicit terms of the employment contract: members were declared redundant and buy-out schemes were employed. Explicitly, the contract always allowed employment ‘at the pleasure of Her Majesty’, but except for competency and disciplinary reasons, life-time employment was expected. Clearly, labour lost expected rent and the employer lost credibility as a life-time employer.

With less rent to be shared and lowered costs of hazards, alternative governance mechanisms became open for analysis. In addition, the shedding of military personnel in many countries and the increase in less combat-intensive operations have given rise to new competitors in the form of private military companies, security companies, engineering construction companies, and provisioning support companies. Ex-military personnel provide a portion of the labour inputs. The employer has clearly chosen the market (or hybrid) option of contracting for these

services where the period of time and services to be rendered can be easily specified. A governance system that is less attached contractually with non-combat activities is consistent with there being little rents to be shared in this activity.

There remains quasi-rent to be shared when output is directed towards combat activities and hence one would predict the continued use of long term implicit contracts. While the planned inventory of final goods and services may be stable, the demand for their use by political authorities may vary. To the extent that usage is largely discretionary in the post Cold War era, excess or peak demands might be most efficiently met by using the market directly through express use of short-term contracts and signing bonuses, as occurs presently in Canada.[26]

Summary

The transactions cost approach suggests that DND is encountering pressures to change its governance structures in all of is transactions locations. The changes in the transactions environment can be traced to the collapse of the Soviet threat and to the increased technical sophistication of physical and human capital assets. These changes tend to move the final goods and services towards hybrid forms from hierarchy; the materials supply system from hierarchy to hybrid; capital procurement from market to hybrid; and intermediate goods towards hybrid from hierarchy. The hierarchical relationship between labour and the firm can be expected to persist with some resort to market pricing systems to handle peak load requirements.

CONCLUSION

The structure of National Defence has been changing but it is not sufficient to argue that this has been a result of budget cuts. Simply reducing output or searching out 'inefficiencies' can reduce budgets. The key features of the changes to National Defence have been in its governance structure. The transactions cost environment has changed dramatically over 15 years. The new cost environment is independent of the desired number of personnel or the scale of the budget. The TCE approach to analysing these changes views the whole hierarchy as being buffeted by the transactions environment rather than desired changes in scale.

The hierarchy is moving toward hybrid relationships, in small steps or large, in every transactional location; final goods and services, primary inputs within industry sectors, and intermediate goods. Governance structure is a choice variable that has important implications for the cost structure of DND but is not independent of National Interests.

A number of related questions arise. Will national procurement policies allow long-term leasing or retainers? Will a hybrid form of supply chain management change the number of military personnel? Will foreign policies allow the Canadian Forces to engage in larger-scale training exchanges? At a higher level, National Interests must be articulated with the knowledge that they will condition many of the changes in the governance structure. For what danger level and at what frequency should National Defence prepare? Can hybrid governance of some activities give rise to catastrophic hazards? Do the hazards of hybrid governance structures risk diminishing the direct control of Government over Defence output? The existence of such

[26] Peak demands are short run fluctuation rather than persistent demand levels. Military personnel cannot be classified as operational all of the time. Support and training parts of the cycle allow rest and recuperation after operational postings. Under-manning implies that non-operational periods are insufficient for long-term personnel maintenance. Peak demands call for retention benefits (short-run quasi-rent to a subset of labour) while chronic under-manning calls for a benefit increase for all (transfer of quasi-rent from firm to labour).

feedback channels imply that decisions about scale, procurement, and hazard reduction and governance structure must be made simultaneously rather than sequentially.

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