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**Re-conceptualising the Military-Industrial Complex:
A General Systems Theory Approach**

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ABSTRACT

This paper examines the prevailing model by which the interplay between defence establishments and defence industries – the military-industrial complex – has been understood, focusing primarily on the defence industrial base. It argues that given global change drivers such as the end of the Cold War and the concomitant reduction in the geostrategic threat level, as well as defence globalization, post-industrialism and the revolution in military affairs (RMA), the old model has ceased to have utility for both researchers and policymakers. Instead, this paper suggests an approach that goes beyond conventional economic analyses and draws on organization theory to develop a dynamic model that better reflects the current realities in defence industrial sector. This paper articulates what a general systems conception of the defence industrial system might consist in, and highlights its potential in informing the defence industrial policy process as well as agenda for future research.

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Re-conceptualising the Military-Industrial Complex: A General Systems Theory Approach

Introduction

Much of the research on relationship between defence ministries and defence industries – what is referred to in the literature as the military-industrial complex – has primarily consisted of empirical or quantitative studies, focusing either on macro-level trends (e.g. the effects of defence globalization, economics of defence industrialization etc.), or developments at the micro-level (e.g. defence industrial and technology policies, the transformation of the defence firm etc.).¹ However, such studies have been underpinned by theoretical models that were developed in the late 1960s and early 1970s.² Consequently, while a robust body of empirical research on the military-industrial complex currently exists, the military-industrial complex as a concept itself has remained under-theorised. Furthermore, given that such models were developed in a particular historical, political and strategic context, the end of the Cold War together with accelerating trends since the late 20th century – the advent of post-industrial or post-Fordist society; the revolution in military affairs (RMA); and defence globalization – have combined to accentuate the inadequacies of the classical models in the face of current realities. At the conceptual level as well, the study of defence industries and their relationship with their customers – defence ministries and armed forces – has typically occurred in isolation, with economic variables privileged over extra-economic albeit highly relevant variables such as politics, strategy, threat perception, doctrine and the like. These have either been conspicuous by their absence or assumed away as variables exogenous to the analysis. Paradoxically, the

¹ Examples of macro-level studies include R.A. Bitzinger, *Towards a Brave New Arms Industry*, Adelphi Paper 356 (London: The International Institute for Strategic Studies, May 2003) and A.W.J. Kuah, 'The Political Economy of Defence Industrialization in Singapore: The Costs, Trade-Offs and Synergies', *Defence Studies* 5:2 (2005), pp. 1-15. Examples of more focused micro-level research include R. Matthews and J. Parker, 'Prime Contracting in Major Defense Contracts', *Defense Analysis* 15:1 (1999), pp. 27-42 and K. Hartley and T. Sandler, 'The Future of the Defence Firm', *Kyklos* 56:3 (2003), pp. 361-80.

² Our understandings of the military-industrial complex were first articulated and developed in now-classic articles in the *American Economic Review* in the 1960s and 1970s: W. Adams, 'The Military-Industrial Complex and the New Industrial State', *American Economic Review* 58:2 (1968), pp. 652-65; S. Melman, 'Ten Propositions on the War Economy', *American Economic Review* 62:1/2 (1972), pp. 312-18; W. Adams and W.J. Adams, 'The Military-Industrial Complex: A Market Structure Analysis', *American Economic Review* 62:1/2 (1972), pp. 279-87. It should be pointed out that, despite the use of politically-charged terms like 'military-industrial complex' and 'war economy', the analyses conducted in these studies were largely confined to the economic structure of the defence market, with politics and institutional factors examined only obliquely.

military-industrial complex, because of the uniqueness of the defence sector and the imperatives of national security, is more a function of these extra-economic variables, rather than the outcome of pure economic rationalism.

In this paper, I begin with a critical evaluation of the classical model of the military-industrial complex – essentially, a monopsony-oligopoly market structure with imperfect information – and examine the extent to which the different assumptions of the model still hold given not only the current strategic environment, but the broader socio-political context. I especially focus on the industry dimension of the complex. Second, I argue that by expanding the analytical scope beyond conventional defence economics to draw on organizational economics and theory, an understanding of the military-industrial complex that better reflects current environment can be obtained. While technical and analytical rigour is sacrificed by diluting the disciplinary boundaries of the field, the additional insight afforded by a broader and more socialized understanding of the military-industrial complex outweighs the loss of disciplinary coherence. Similarly, Dunne *et al.* have highlighted the importance of contextualizing defence economic issues within broader political and social trends, arguing for the need to ‘draw on comparisons between the putative New Economy of defence, the RMA and asymmetrical warfare, and the putative New Economy in Civilian life [...]’.³ Finally, drawing on general systems theory, I offer an open-system conception of the military-industrial complex. I start by showing the growing inadequacies of using the classical model based on the conventional and static positing of the customer (the military establishment, generally comprising defence ministries and armed forces) and the producer (the defence industrial base and the defence firms that populate it) in a simultaneously adversarial and symbiotic relationship, juxtaposed against an environment where issues of doctrine and politics are held constant. I then propose an open-system model where the broader military-industrial complex is treated as a dynamic organization writ large. In other words, moving away from a static notion of the military-industrial complex where the military establishment and the defence industrial base are distinct entities, to a more

³ P. Dunne, M Garcia-Alonso, P. Levine and R. Smith, ‘The Economics of the RMA’, 2003 at <http://carecon.org.uk/Armsproduction/ASSA2003pap.pdf>, pp. 1-2. See also the various books by Alvin and Heidi Toffler. The underlying theme addressed in their work has been the relationships between technological change, social forces and trends in warfare, with the latter made explicit in A. Toffler and H. Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century*, (London: Warner Books, 1993).

dynamic conception of a *defence industrial system*, where defence production is enmeshed within an increasingly boundary-less network that incorporates the other vital agents such as the military establishment, the civilian political economy, and the global environment. That way, not only can the complex interplay between the buyers and sellers be tracked, but also the relationship between the defence industrial system and its environment, as well as other national defence industrial systems.

THEN: The Classical Conception of the Military-Industrial Complex

In this section, I unpack the prevailing model of the military-industrial complex as articulated in the classic *American Economic Review* articles from the 1960s and 1970s, and evaluate the degree to which it effectively tracked developments on the ground. I then proceed to focus on the ‘industrial’ component of the military-industrial complex equation – the defence industrial base – and examine the different qualities that differentiate it from other civilian industrial structures. I argue that its uniqueness, stemming from its national and defence characteristics, have shaped a particular way of thinking about defence industrial issues both in policy and academic circles, and precluded alternative thinking about the defence base.

The point of departure for modelling the military-industrial complex is the 1972 *American Economic Review* article entitled ‘The Military-Industrial Complex: A Market Structure Analysis’ by Walter Adams and William James Adams, which located the level of analysis at the market structure. They argued that the ‘best explanation of poor performance in the military-industrial complex is the uncertainty emanating from inadequate technological information and the monopsony-oligopoly configuration it promotes.’⁴ Summarizing their argument, this market structure arises due to both natural determinants and artificial structural forces; namely defence industrial policy. In terms of the natural determinants, they argued that because of the intrinsic technological uncertainties of weapons systems and other equipment – technical attributes, performance, final costs, all of which cannot be known *ex ante* –

⁴ W. Adams and W.J. Adams (note 2), p. 282. The oligopoly dimension means that, because the market mechanism cannot be relied upon to reveal technology and cost information, the buyer cannot be sure that he is procuring at least cost. Hence, government monopsony power is countered by imperfect information induced by industrial oligopoly. Correspondingly, there is no incentive for defence firms to minimize costs. These constraints result in defence ministries changing their focus to setting product performance criteria rather than product costs.

the government has to select contractors on the basis of imperfect information (i.e. both price and non-price information). Furthermore, because defence procurement is almost never a once-off game, the government has to bear in mind the impact of its procurement decisions on the future capacity of the industry to meet its later needs. Artificial forces, chiefly defence industrial policy, also play an instrumental role in the shaping the structure of the defence market: after all, 'it is the government which ultimately determines who shall enter and survive in the defense industry.'⁵ Indeed, the allocation of defence contracts and the shelter accorded to industry through supportive government policies (e.g. privilege creation, subsidies, bailouts etc.) mean that defence firms, to a large extent, are 'creatures of political power'.⁶ A graphical representation of this model is shown in Figure 1.

The most salient point for this paper's purpose is that the market structure of the military-industrial complex is one which is economically inefficient on two fronts. On one hand, allocation decisions are determined by the defence ministry rather than by market forces, which may not represent the most optimal employment of scarce resources. On the other hand, the combination of oligopoly and imperfect cost information results in production inefficiencies, which are borne by the government and, by extension, the broader economy. The first aspect is underscored by Melman in regard to the US case: '[for] the military-industrial firm, final decision making in each of these spheres is retained by the top management located in the Department of Defense'.⁷ Crudely speaking, the defence ministry tells industry what to research, develop, produce and sell, and decides how all these activities are to be funded and conducted. At the same time, the power enjoyed by defence firms has translated into inefficiencies and escalating costs, and where these costs are borne by the government.⁸ The protective shelter enjoyed by defence firms means that '[i]ncompetence, extravagance, or mismanagement are no threat to their survival. If

⁵ *Ibid.*, p. 283.

⁶ W. Adams (note 2), p. 656.

⁷ S. Melman (note 2), 313. The 'spheres' Melman refers to are (i) methods of capital raising, (ii) the product to be produced, (iii) quantity of output, (iv) how production should take place, (v) price, and (vi) distribution. To all these can be added technical and performance criteria. Elaborating on point (iv), because of oligopoly power and imperfect technology and cost information, there is no incentive for producers to prefer least cost production methods. Hence, while production methods may have been pre-specified, there is no guarantee of efficiencies in the production process.

⁸ There is a trend, especially as the technology content of major weapons systems and other equipment increases and production runs decrease, for costs to increase over time anyway. However, the costs of inefficient production add onto 'naturally' increasing costs.

adversities strikes...these companies can count on government bailouts'.⁹ Schematically, the relationship is shown in Figure 2.

While the 'military' element of the military-industrial complex equation is relatively unproblematic (being, in the main, defence ministries and armed forces), the 'industrial' component is highly fungible and thus lends itself to various ways of defining it.¹⁰ A few examples will suffice to demonstrate this point. Dunne offers an entry-level definition of the DIB, reflecting what he termed its 'ephemeral character', as that which is '[constituted by] those companies which provide defence and defence related equipment to the defence ministry'.¹¹ Dunne also goes on further to suggest a functionalist approach: defence products are divided into three main categories: weapons systems (e.g. means designed to destroy or disable various targets); specialized auxiliary equipment (e.g. command and control systems, communications and detection systems etc.); and general purpose products (e.g. vehicles, medical equipment etc.).¹² Another conception builds on a public policy perspective, where the defence industrial base is defined as that towards which the government maintains an explicit policy to assure their existence for national security purposes.¹³ Finally, the defence industrial base can also be defined from the defence firm perspective; i.e. the defence industrial base is the sum total of defence firms operating within national boundaries.¹⁴

Clearly, there are many difficulties associated with the different methodologies used in defining the defence industrial base. However, given the

⁹ W. Adams and W.J. Adams (note 2), p. 284.

¹⁰ For a comprehensive survey of various approaches to defining the defence industrial base, as well as to tracking its evolution, see Y. Lifshitz, *The Economics of Producing Defense: Illustrated by the Israeli Case*, (Norwell, Massachusetts: Kluwer Academic Press, 2003), pp. 143-50.

¹¹ J.P. Dunne, 'The Defence Industrial Base' in K. Hartley and T. Sandler (eds.), *Handbook of Defense Economics*, (Amsterdam: Elsevier, 1995), pp. 402.

¹² *Ibid.*, pp. 402-3. This approach has also been critiqued in Y. Lifshitz (note 4), p. 143, who argues that '[while] the borderline could be drawn between the first two groups and the third, [...] the close interdependence among all three in modern warfare removes any significance from this traditional functional distinction.'

¹³ E.B. Kapstein, *The Political Economy of National Security: A Global Perspective*, (South Carolina: University of South Carolina Press, 1992), *passim*.

¹⁴ Y. Lifshitz (note 10), p. 144. This definition, of course, is contingent on what exactly a defence firm consists in. Lifshitz offers a three-tiered classification of prime contractors, subcontractors and basic suppliers. The problem is, because of the complexity of the supply chain, some companies are not aware that their products eventually end up in a defence product, and consequently do not consider themselves defence firms.

historical context of when the military-industrial complex was first theorized, all of these methods converge rather than diverge. The confluence of the Cold War, the then-existing state of technology, and the type of defence firms prevalent during that era, allowed for the peculiar conception of the military-industrial complex described above. Furthermore, it allowed for the defence industrial base to be treated as a distinct, closed-system populated by identifiably defence firms. The high levels of demand by defence establishments and the consequent high military budgets served to reinforce the monopsony-oligopoly structure and its adversarial dynamic, while at the same time solidifying the coalition of interests between buyers and sellers. From the perspective of industry, the landscape was dominated by the archetypal industrial giants, which were either vertically-integrated or conglomerate giant, with low levels of outsourcing and comparatively insignificant numbers of small and medium sized subcontractors and suppliers.¹⁵ The level of defence globalization and cross-border flow of defence goods, services and technology were also relatively low compared to the present. Finally, the stable logic of the Cold War accorded the imperatives of politics and national security primacy over the economic rationale. Hence, the model of the military-industrial complex could treat extra-economic issues as exogenous.¹⁶

In concluding this section, the historical context of the late 1960s led to an understanding of the military-industrial complex that was not only intrinsically stable despite exhibiting simultaneously antagonistic and collaborative dynamics, but also a closed and mechanistic system which did not incorporate either extra-economic reasons or external environmental influences. The defence industrial base was also a distinctly national entity, with a more-or-less clear demarcation between defence and civilian technologies.¹⁷ Likewise, the dominant form of the defence firm was that of a subsidy-maximising entity that is a '[...] mercantilist corporation, maintained in a privileged position by "royal" franchise'.¹⁸ However, as will be shown in the next section, global developments since the late 20th century have combined to destabilize

¹⁵ For a good survey of US defence industries during the Cold War, see A.L. Ross (ed.), *The Political Economy of Defense*, (Westport, Connecticut: Greenwood Press, 1991).

¹⁶ Y. Lifshitz (note 10), p. 206.

¹⁷ *Ibid.*, p. 147.

¹⁸ W. Adams (note 2), p. 656. Elsewhere in the same article, Adams emphasizes this point by arguing that '[...] government not only permits and facilitates the entrenchment of private power but serves as its fountainhead. It creates and institutionalizes power concentrations which tend to breed on themselves and to defy public control (p. 654)'.

the model, especially eroding the distinctiveness of its ‘national’ and ‘defence’ foundations.

NOW: The Trisection of Global Change Drivers

In the previous section, I examined the classical model of the military-industrial complex, highlighting in particular the features of the defence industrial base. In this section, I argue that because of the impact of these disruptive trends, the prevailing model no longer holds and should give way to an alternative conception where the difficulties of maintaining the categorical separations within the military-industrial equation are circumvented by synthesis within a systems-based, process-oriented approach. These change drivers – the impact of the end of the Cold War; post-Fordism; the RMA and defence globalization – are examined for their impact on the military-industrial complex and defence industries in particular. The first change driver is a quantitative one, in that the end of the Cold War and the consequent fall in defence demand led to a straightforward decrease in the size of the military-industrial complex and a traumatic process of recalibration. The other three change drivers, however, are discontinuous and non-linear shocks leading to qualitative changes in the classical model, thereby provoking the alternative systems theory approach being considered in this paper. A graphical representation of these global change drivers is depicted in Figure 3.

Quantitative Change Driver: End of the Cold War

The end of the Cold War and the global strategic landscape that emerged in its wake led to dramatic structural transformations within the military-industrial complex.¹⁹ Anthony articulates the consensus view, writing that ‘[w]ith the end of the Cold War there has been an enormous reduction in the levels of military effort by the major powers. This reduction in effort has in turn been reflected in the diminished

¹⁹ For in-depth analyses of the post-Cold War defence industries, see A.R. Markusen and S.S. Costigan (eds.), *Arming the Future: A Defense Industry for the 21st Century*, (New York: Council on Foreign Relations Press, 1999) and A.R. Markusen, S. DiGiovanna and M.C. Leary (eds.), *From Defense to Development?: International Perspectives on Realizing the Peace Dividend*, (London: Routledge, 2003).

demand for military equipment'.²⁰ Likewise, Bitzinger has noted the severe retrenchment in defence industries in the major arms-producing countries, where the budgets and demand for weapons systems and other military goods has led to excess capacity throughout the industry.²¹ This has led to attempts by both militaries and defence firms to restructure, even downsize, to a level that is congruent with the geostrategic environment. For defence firms, not only have they had to cope with falling demand, but also with the great uncertainty associated with defining new threats and anticipating the roles and missions their customers would undertake in the post-Cold War period. Needless to say, restructuring programmes – strategic transformation in the case of the military; strategies such as civilianisation; mergers and acquisitions; industrial consolidations; exiting the defence market and conversion in the case of defence firms – have all met with varying degrees of success.

However, what has been more important than the reductions in defence budgets, and the corresponding adjustments in both the armed forces and the defence firms, is the loss of national consensus on defence spending. This has largely come about due to changes in the perception of the level of global geostrategic threat, resulting in a loss of national consensus on defence spending and the erosion of the once unchallengeable status of defence spending within the broader national agenda of resource allocation. In commenting on the Israeli experience, Lifshitz noted that 'when threats diminished, politicians' readiness to weigh purely military considerations diminished as well, especially when these conflicted with employment and other economic interests of their voting district'.²² This then relates to the earlier sections in which the political and socio-economic variables could be treated as exogenous outside the classical model because of the stability of the geostrategic logic. The end of the Cold War therefore meant that defence no longer occupied a privileged position in the resource allocation process, where economic considerations were now equal in importance to security criteria in determining the size of the

²⁰ I. Anthony, 'Politics and Economics of Defence Industries in a Changing World' in E. Inbar and B. Zilberfarb (eds.), *The Politics and Economics of Defense Industries*, (London: Frank Cass, 1998), pp. 1.

²¹ R.A. Bitzinger (note 1), *passim*.

²² T. Lifshitz (note 10), p. 206.

military-industrial complex.²³ In addition, this has resulted in ‘market-led economics chipping away at the notion that defense is a “public good”’.²⁴ Hence, in addition to the downsizing of the broad defence establishment and industries, there is also now a tension between the national security constraints that underpin the military-industrial complex and the economic imperatives that were unleashed by the end of the Cold War.

Qualitative Change Driver I: Post-Industrialism

This sub-section turns to the first qualitative change driver, which is the advent of post-industrialism, or post-Fordism, and its impact on the structure and processes within the military-industrial complex, as well as the broader social, economic and political context. I also examine the asymmetric effects that post-industrialism has had in the defence and non-defence spheres, chiefly from the environmental/organizational perspective.

Post-industrialism is a highly contested notion, with debates centred on whether it is a fundamentally different and distinct phase of industrial development, a quantum and discontinuous change from what had gone on before, or merely the latest episode in the longer process of industrial development, representing incremental and linear change.²⁵ These disagreements notwithstanding, there is broad agreement that the emergent post-industrial society has consisted of the ‘informatization’ of society where the knowledge and services sectors surpass manufacturing in terms of importance, and knowledge-based workers (i.e. owners of intellectual property) replace capitalists (i.e. owners of capital) as the key players in society. Bell draws a distinction between ‘[...] industrial societies [which are] organized around the control of labor in the production of goods, [whereas] post-industrial society is organized around the creation of knowledge and the uses of information’.

²³ *Ibid.*, p. 41. One irony is that the study of the military-industrial complex, a creature of strategic and security constraints, was basically an exercise in economic analysis, with extra-economic variables held constant (see Introduction). With the Cold War’s end, the changes in the political, social and strategic variables mean that any meaningful understanding of the military-industrial complex must consist in both economic and extra-economic analyses.

²⁴ R. Matthews and J. Parker (note 1), p. 27.

²⁵ For a survey of the post-industrialism literature, see D. Bell, *The Coming of Post-Industrial Society*, (New York: Basic Books, 1973) and A. Toffler, *Future Shock*, (New York: Random House, 1970)

In terms of the impact on organizational and industrial forms, this has led to the gradual abandonment of hierarchies in civilian organizations (more so in the private sector, but increasingly in the public domain) in favour of communication networks with a shift from vertically to horizontally structured organizations.²⁶ This poses interesting questions on whether and to what extent such transformations can occur within the defence establishment. Hatch goes on to note that post-industrial organization forms will be characterised by the disappearance of distinct organization boundaries, either between different organizations or organizations and their environment.²⁷ This clearly reinforces the argument advanced in the previous section on how untenable it is to maintain spatially distinct categories between the military establishment and the defence industrial base.

In terms of post-industrial technology, the most significant impact has been in the production process. The Tofflers single out the 'de-massification of mass production', where post-industrial technologies enable a shift away from mass production using fixed and routine processes, to flexible manufacturing and automation with increasing reliance on information technology (IT) and just-in-time (JIT) systems on management and control.²⁸ More importantly, it also entails a shift in the performance monitoring metric from manufacturing output to service/information output.

At this point, it remains to be seen what impact the combination of post-industrial organization forms and production technologies can have on the military-industrial complex, given its unique institutional and structural features, and the uniqueness of the defence establishment that sets it apart from other contexts. Lifshitz argues that there will be limits to the application of the post-Fordist paradigm to the defence sector, given constraints such as the great uncertainties defence firms face, the preference for performance and quality over costs and efficiency, and the

²⁶ M.J. Hatch, *Organization Theory: Modern, Symbolic and Postmodern Perspectives*, (New York: Oxford University Press, 1997), pp. 23-25.

²⁷ *Ibid.*, pp. 26. Hatch cites as examples of alternative industrial and organizational forms such as joint ventures, strategic alliances and virtual organizations, many of which are being adopted in the defence sector.

²⁸ A. Toffler and H. Toffler (note 3), p. 72.

prevalent risk-averse conservatism that defines the military-industrial complex.²⁹ However, even if the post-industrial paradigm is adopted imperfectly, it would be sufficient to render obsolete the present understanding of the military-industrial complex, and stimulate thinking about alternative forms of organization and production in the defence sphere.

Qualitative Change Driver II: The Revolution in Military Affairs

Like post-industrialism, the revolution in military affairs (RMA) has also proved to be a highly elusive concept. Freedman locates the revolution at the higher realm of strategic affairs of which the technically-oriented RMA is a major element, alongside transformations in political and business affairs.³⁰ O'Hanlon's wide survey of different approaches to studying the RMA distils four main schools of thought: *system of systems* school, which emphasises networking capabilities and real-time data processing to enhance warfighting capabilities; *dominant battlespace knowledge* school, based on superior sensor technologies that renders the battlespace transparent; *global reach, global power* school, which focuses on mobility and the ability to project force globally; and *vulnerability* school, which stresses asymmetric warfare as a defining feature of future warfighting.³¹ However, despite these different approaches, what is common is that attaining each of these visions entails changes in defence demand geared especially towards networked weapons systems and C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) and sensor capabilities, and the ability of the defence industrial base to transform in order to respond to these new demands. For the purposes of analysing the impact of the RMA on the military-industrial complex, I focus on the technical requirements needed for armed forces to be RMA-capable.

The impact of the RMA on the military industrial base is transmitted via changes in a wide range of variables that were held constant in the classical model. These variables include threat perception, strategy, doctrine, and broader socio-

²⁹ Y. Lifshitz (note 10), p. 174.

³⁰ L. Freedman, *The Revolution in Strategic Affairs*, Adelphi Paper 318 (London: The International Institute for Strategic Affairs, April 1998), *passim*.

³¹ M. O'Hanlon, *Technological Change and the Future of Warfare*, (Washington DC: Brookings Institution Press, 2000), pp. 11-17.

political and economic issues. The net is cast wide in order to echo Matthews' call to increase the expansiveness of the RMA concept: '[w]hat was originally a "military" technology revolution has now evolved to capture information and media warfare, military doctrinal and organizational change, civil industry and dual-use technologies'.³² However, the most significant impact comes from the uncertainties as to the types of missions armed forces will have to undertake in the post-Cold War RMA environment. The new threats and different military operations that arise from this then lead to changes in the composition of defence demand, which will have a significant effect on the military-industrial dynamic, as well as the structural capacity of the defence industrial base. Lifshitz argues that, because of this, 'long established activities may lose their value completely, and leading defense companies may disappear'.³³ The corollary of this, of course, is that there will be new entrants to the defence sector, especially the small and medium firms that better integrate civilian and defence technologies in end-products and production processes. Hence, winners and losers are created. On the issue of losers, reduced defence budgets and the waning primacy of defence in the national agenda could also mean greater unwillingness to bail out failing companies, thereby altering the logic of the military-industrial complex.

In summing up this sub-section, I argue that the RMA is a qualitative change driver because of the knock-on effects on the government and defence industries. The types of systems and equipment needed to effectively negotiate the RMA environment are highly effective in terms of performance, but technology-intensive and extremely costly. The combination of high costs and high performance means that RMA-ed militaries will likely acquire few types of systems and hardware, and in smaller numbers, which leaves little room for producers (this last point is discussed in the next sub-section on defence globalization). At the same time, there is a double-edged effect on defence industries: the RMA stimulates demands for the development of new products, reinvigorating the industry; however, the infusion of civilian technologies into the sector could crowd out long established defence industrial competencies if the convergence process is mismanaged. The military-industrial

³² R. Matthews, 'Introduction: "Managing" the Revolution' in R. Matthews and J. Treddenick (eds.), *Managing the Revolution in Military Affairs*, (New York: Palgrave), p. 3.

³³ Y. Lifshitz (note 10), p. 160.

complex model as it stands cannot explain how these uncertainties and shocks introduced by the RMA can be accommodated.

Qualitative Change Driver III: Defence Globalization

A widely accepted definition of defence globalization is that it consists in, among other things, ‘the internationalization of the development, production, and marketing of arms’. Furthermore, defence globalization has led to wholly indigenous arms production being supplanted by multinational and even transnational development processes and supply chains.³⁴ The emerging picture is one of increasingly transnational defence technologies; where the military industrial-complex is driven not just by defence interests but also commercialisation principles, and the defence industrial base is losing its national distinctiveness. With the emergence dual-use technologies and the intensification of technology flows between the civilian and defence sectors, not only is the defence industrial base less *national* in character, but also less *defence*.

The international aspect of the defence industry has been around since the beginning of the 20th century, with the growth of industrial capitalism creating large private defence companies that dominated the world arms market. Indeed, as Lifshitz has pointed out, a critical reversal occurred during the Second World War, where entire national economies were geared towards war production, and the defence industrial base became exclusively national entities.³⁵ Starting in the 1970s, defence companies became more internationalized through export sales on the one hand, and relying on foreign suppliers of components and materials on the other hand.³⁶ What sets defence globalization apart from internationalization are the various transnational processes and structures it has engendered in defence industrial activity. These range from simple collaborative activities such as technology transfers and offset arrangements, subcontracting and licensed production, to more elaborate arrangements such as cross-border co-development and co-production projects, and

³⁴ R.A. Bitzinger, ‘The Globalization of the Arms Industry: The Next Proliferation Challenge’, *International Security* 19:2 (Fall 1994), pp. 170-98.

³⁵ Y. Lifshitz (note 10), p. 148-9.

³⁶ For additional overviews of the internationalization and globalization trends in the defence industry, see E.B. Kapstein (note 13) and A.L. Ross (note 15).

industrial consolidation on a global scale. The cumulative impact on the military industrial complex has been to render it more open and susceptible to global developments, and to enmesh the erstwhile national defence industrial base in global supply and production networks, at different levels of the value chain. At the defence industrial policy level, this raises questions about the costs, benefits and viability of maintaining indigenous defence industrial capabilities, and to what degree.

Defence globalization also affects the military-industrial complex in terms of the technology and commercialization dimensions. The information technology revolution of the late 1970s sparked the convergence of defence and civilian technologies, a trend that is accelerating under the added impetus of the RMA. However, the convergence of defence and civilian technologies has not merely led to the proliferation of dual-use end products and, consequently, procurement patterns; rather, the impact has also been at the level of defence industrial production and organization. First, as defence industries grew more dependent on civilian technologies, the categorical separation between the two spheres became more porous: as Lifshitz noted, ‘defence industry became less exceptional’.³⁷ Convergence is occurring in the sense of production facilities producing military and civilian products with the same production technologies.³⁸ Second, with procurement preferences turning increasingly towards civilian goods as substitutes for defence ones, and defence demand being met from companies not traditionally regarded as defence firms, fragmentation in the defence industrial landscape has occurred. That is, while the number of major defence platforms manufacturers and systems integrators has declined, the number of small and medium-sized subcontractors with both defence and civilian market capabilities has rapidly increased.³⁹

On the commercialization front, defence globalization has led to a ‘revolution in business affairs’ that is occurring alongside the RMA.⁴⁰ This has manifested itself in a series of concepts that are gaining currency within the military-industrial

³⁷ Y. Lifshitz (note 10), p. 157, 206.

³⁸ J.S. Gansler, ‘The Future of the Defence Firm: Integrating Civil and Military Technologies’ in A. Latham and N. Hooper (eds.), *The Future of the Defence Firm: New Directions, New Directions*, (Norwell, Massachusetts: Kluwer Academic Press), *passim*.

³⁹ *Ibid.*

⁴⁰ L. Freedman (note 30), p. 8. See also K. Hartley, ‘The RMA: an Economist’s View’ in R. Matthews and J. Treddenick (eds.), *Managing the Revolution in Military Affairs*, (New York: Palgrave).

complex, concepts that are derived largely from best practices in the private sector. These include commercial off-the-shelf (COTS) procurement, outsourcing, lean and agile logistics and inventory controls, resource accounting and budgeting (RAB), and private finance initiatives – all of which are driven essentially by the imperatives of promoting greater efficiency, reducing costs and obtaining value for money (VfM). At a broader level, these initiatives illustrate how economic necessity has undermined the notion of defence as a ‘public good’, introducing questions of costs, competitiveness and efficiency into the resource allocation calculus.

It is a cliché to say that the defence sector is different from all other sectors, and that defence globalization is not a perfect microcosm of the broader globalization process because of there are limits to it that are circumscribed by security and strategic considerations. As Matthews has argued, ‘the more global the defence supply chain, the less security there is in supply’. Nevertheless, he also noted that the policy challenge lies in ‘[embroidering] the defence sector into the fabric of globalization, whilst still protecting the “crown jewels” of national defence technology.’⁴¹ In other words, rather than uncritically treating the rationale for the indigenous defence industrial base as sacrosanct, the antagonistic logics of defence globalization and national security will at least stimulate debate within the discourse on defence industrial policy.

Clearly, all of the change drivers described above are interrelated phenomena and act in combination, and are indeed themselves subjected to feedback dynamics from the military-industrial base. To summarize the above: First, post-industrialism and defence globalization, with the increasingly sophisticated major weapons systems platforms and critical subsystems (from foreign vendors, at that) mean that it is no longer feasible to think of a *national* defence industrial base, given the highly-complex global supply and production chains in which national defence industries are embedded. In other words, the boundaries surrounding the national defence industrial base are increasingly being blurred and enmeshed in global, or at least regional, supply and production chains. Adding to that, the relationship between the defence customer and industry has undergone a qualitative change, giving rise to a sharp

⁴¹ R. Matthews (note 32), p. 11.

market fragmentation due to the emergence of small and medium-sized subcontractors and subsystem suppliers alongside the traditional prime contractors. Second, the RMA and defence globalization, and the emergence of post-industrial technologies, not only in dual-use end-products but the convergence of civilian and defence production processes, also mean that defence production capability is losing its *defence* distinctiveness, and hence its elevated and unquestioned status in the resource allocation process. Finally, the RMA – amidst post-industrial society, with the doctrinal changes wrought by emerging uncertainties and asymmetric warfare – impacts on production processes and organizational structures in the military-industrial complex and the defence industrial base, overturning existing institutional arrangements and structures. All of which, as pointed out earlier, are happening with the end of the Cold War forming the geostrategic backdrop.

NEXT: Towards a Defence Industrial System

The prevailing model of the military-industrial complex, with its distinct spatial categories of the defence establishment and the defence industrial base, made sense because it accurately captured the real life dynamics of defence production. The stable logic of the Cold War, uncomplicated by the disruptive change drivers identified above, made it possible to focus analysis solely on the bi-directional logics of monopsony and oligopoly between the military and industry, while assuming away the other variables as constant and exogenously determined. The analytical utility of the classical model consisted in recognising that, although the military-industrial complex was largely a function of non-economic variables, the stability of the global context made it possible to ignore such variables and focus on the economic determinants of the model. As was demonstrated above, this no longer holds.

In this section, I propose an open systems approach to understanding the dynamics of defence production which draws broadly on organization theory, with a particular emphasis on the general systems approach to studying organizations. Adopting such an approach expands the analytical scope which allows for the complex dynamics engendered by the transformations above. A dynamic systems approach would circumvent problems of definitions and categorizations arising from

the disruptions and destabilizations caused by the discontinuous change drivers, allowing the focus to be on processes, flows and networks instead.

The generally accepted definition of organization within organization theory is 'a social unit with some particular purposes'.⁴² However, this conventional definition implies an organization as a distinct, static entity with clear boundaries that is acted upon by, first, its immediate network and, second, its broader environment. This definition accords with the conception of the military-industrial complex set out in Figure 1, where the defence industrial base is posited as the organization, and the military establishment is seen as its inter-organizational network (e.g. customer, regulator, patron etc.), and where the broader environmental variables are extraneous to the complex and held as constant. In a sense, this is a closed system, which is highly predictable and determinate.⁴³ By drawing on the general systems approach first conceived by Ludvig von Bertalanffy in the 1950s, an open system model of the 'defence industrial system' is suggested, where the defence industrial system is treated as an open-systems organization, where defence production occurs at the confluence of other subsystems, thereby replacing the closed system model of the military-industrial complex.⁴⁴

This paper adopts the definition of system as 'any organized collection of parts united by prescribed interactions and designed for the accomplishment of specific goals or general purposes'.⁴⁵ Hatch suggests a much simpler definition of system as 'a thing with interrelated parts'.⁴⁶ These seemingly straightforward definitions should not obscure Bertalanffy's original intention, which was that all disparate natural and social phenomena could be abstracted and synthesized into a unified higher-level, systemic conception. Whether or not this Hegelian vision can be attained is a separate

⁴² J.M. Shafritz and J. S. Ott (eds.), *Classics of Organization Theory, 5th Edition*, (Belmont, California: Wadsworth), p. 1.

⁴³ J.D. Thompson, 'Organizations in Action' in J.M. Shafritz and J. S. Ott (eds.), *Classics of Organization Theory, 5th Edition*, (Belmont, California: Wadsworth, p. 268-81. Thompson draws a distinction between a 'closed system', which is driven by the search for certainty and underpinned by a stable environment, and an 'open system', which is characterized by the expectation of uncertainty and enmeshed in a fluid environment.

⁴⁴ L.V. Bertalanffy, *General Systems Theory: Foundations, Development, Applications*, (New York: George Braziller, 1968).

⁴⁵ J.M. Shafritz and J. S. Ott (eds.), *Classics of Organization Theory, 5th Edition*, (Belmont, California: Wadsworth), p. 242.

⁴⁶ M.J. Hatch (note 26), p. 35.

issue; however, this gives rise to three important implications for organization theory. First, while all systems can be broken down into subsystems, the essence of the system consists in regarding it as a whole. In other words, the system as more than the sum of its subsystems. For this paper's purpose, the analytical starting point is the defence industrial system itself, rather than attempting to identify the different elements that comprise it.⁴⁷ Second, it becomes more useful to focus on the interplay between the different subsystems instead of the subsystems themselves. As Katz and Kahn put it, the open system approach focuses on the '*repeated cycles* of input, transformation, output, and renewed input which comprise the organizational pattern [italics mine]'.⁴⁸ Finally, because it is possible to calibrate upwards or downwards in terms of analysis (e.g. system A which encompasses many subsystems itself becomes a subsystem of a higher-level system B), the contradictions that arise at the subsystem level can be accommodated at the higher systemic level. This resonates with the Hegelian notion of thesis-antithesis-synthesis. It also means that general systems analysis is 'backward compatible': an open-system can accommodate a closed-system but not *vice versa*.⁴⁹ For this paper, the model of the defence industrial system (open system) can also explain the dynamics captured by the classical military-industrial complex.

Following from the above discussion, an open-systems model of the defence industrial system depicted in Figure 4 suggests itself. The defence industrial system consists in the union of the overlapping circles, each depicting the economic, strategic, doctrinal and technology subsystems, with defence production occurring at the intersection of the four circles. Finally, this schematic also identifies the linkages that exist between different defence industrial systems, underscoring the tension that exist between trending towards a global defence supply chain and the resistances inherent in a still nationally-based defence sector.

⁴⁷ An important point of methodology needs to be made here: mapping the different subsystems is an exercise in identifying flows, because they are simply repeated patterns of inputs, process and outputs that feed into a higher level system. Trying to define the elements of the system is futile, because of the incongruence between elements (static) and systems (dynamic). In mathematics, the distinction is also made between sets and subsets, and elements of a set.

⁴⁸ D. Katz and R.L. Kahn, 'Organizations and the System Concept' in J.M. Shafritz and J. S. Ott (eds.), *Classics of Organization Theory, 5th Edition*, (Belmont, California: Wadsworth), p. 266.

⁴⁹ K.E. Boulding, 'General Systems Theory – Skeleton of a Science', in *Management Science*, 2:3, pp. 197-208, *passim*.

This model replaces the previous spatial categories with a mapping of the dynamics between different subsystems. The four subsystems depicted by the circles are chosen on the basis of the earlier analysis of the global change drivers. This schematic also corresponds to the overlap between the different change drivers where the subsystems are generated. For example, in Figure 3 the technology subsystem is driven by the dynamics of the RMA and defence globalization. The broken lines used in the schematic represent the porousness of the boundaries between the subsystems, highlighting not only the two-way flow of inputs and outputs between the subsystems, but also the defence industrial system and its broader environment, enabling the notion of the defence industrial system as a dynamic, boundary-less organization to be captured. The benefit of this model is that by switching from the appropriate broken lines to solid lines, the system can be changed from an open system to a closed one, thereby reverting to the classical model. Hence, the Cold War environment, where the defence sector was largely closed and where the imperatives of strategic imperatives were held constant, can be represented by removing the arrow that links to other defence industrial systems and solidifying the ‘strategic subsystem’ circle.

In terms of analytical methodology, this model enables problems of definition and causal primacy to be circumvented. In the first, the definitional problem is avoided by focusing on what the defence industrial system does, rather than what it is. What Matthews has referred to as the black art of defining the defence industrial base becomes moot because the defence industrial base as a distinct entity no longer exists conceptually, bypassing questions of ‘who’s in, who’s out’.⁵⁰ Likewise, the problems of defining what a defence firm is. Indeed, a process-oriented definition of the defence industrial system could be the sum total of the different subsystems that are marshalled towards defence production. In the second, the problem of assigning explanatory primacy to any one cause or set of causes is also avoided because the system is driven by a dialectical flow of inputs and outputs between the subsystems. Furthermore, the insight gleaned from an open systems model depends on the level that one normatively chooses to conduct the analysis. For example, the ability to calibrate upwards or downwards means that one could derive an open systems model

⁵⁰ R. Matthews and J. Parker (note 1), p. 29.

where the level of analysis is the broader industrial system, of which the defence industrial system in this case is a subsystem.

Although this model is only a tentative attempt to capture dynamic processes within the defence production sphere, it nevertheless suggests several implications for further research and policy making. First, the model is flexible enough to shift back and forth between a closed system and an open one. For example, if levels of geostrategic threat are high and the imperatives of the strategy circle dominate the other subsystems, then the allocation of resources to defence production become captured by considerations of national security. However, if threat levels are low and the consensus on defence spending breaks down, then the allocation decision is taken at the confluence of all four subsystems where the outcome is generated by the bargaining between different coalitions of interest. Hence, the method of allocating resources to defence is not an either-or choice of letting the market mechanism decide, or leaving it to the prerogatives of the military establishment, but rather the outcome of the interplay between sub-systemic forces where, at any particular point in time, one dynamic will be relatively stronger than others. After all, the market mechanism can frequently generate an outcome that is incongruent with the dictates of national security, while concentrating the power to make allocation decisions in the hands of the military establishment serves to exacerbate the inefficiencies already inherent in the defence sector.

Second, this mapping of the defence industrial system shows where and under what circumstances the economic rationale can apply to the defence industrial system. Production efficiency is located at the intersection of the four subsystems where production activity takes place. It can then be argued that production efficiency is a function of the dynamics of the economic and technology subsystems that compete against the imperatives of doctrine (where the strict specification of equipment performance criteria is at the expense of cost considerations) and strategy (where a high threat environment can lead to inefficient but strategically necessary excess capacity in defence production). Furthermore, production efficiency also consists in the robustness of the global defence supply chain as defined by the strength of the link between different defence industrial systems. Similarly, attaining allocation efficiency, defined here as the optimal size of the defence industrial system, depends

on the interactions between the various subsystems and the global supply chain, but also the broader resource allocation agenda (e.g. alternative spending on healthcare, education, culture etc.) Finally, the defence industrial system model challenges the established understanding of what defence industrial policy is. The conventional understanding of defence industrial policy has its origins from within the military establishment and traces a unidirectional causal impact leading from the defence ministry to the defence industry, with feedback mechanisms limited because of governmental monopsony power. However, with this open-system approach, and the loss of once-distinct spatial categories, defence industrial policy too has lost its defence distinctiveness, and is now seen to emerge from the interplay of different interests. Hence, ostensibly non-defence policies, because of the open system, could still have an impact on the defence industrial system.

In conclusion, this paper has highlighted some of the inadequacies inherent in how the military-industrial complex and the defence industrial base have been conventionally studied. These inadequacies have been sharpened by the impact of global change drivers, where actual developments and the conceptual model have critically diverged. By shifting away from static, category-based analysis to a more dynamic, systems-oriented approach that better reflects actual developments, I have proposed a model of the defence industrial system that is built on the general systems perspective in organization theory. Clearly, much theoretical work remains to be done in this area and difficulties will surely arise, particularly in how subsystems are mapped and how the intensities of the various dynamics are measured. However, it is hoped that this model will stimulate further research into alternative ways of approaching this topic. The implications of new theoretical concepts will then have knock-on effects, not only on future empirical research but also to help inform the defence industrial policy making process.

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