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Conceptualising the quiet revolution: the post-Fordist revolution in western military logistics

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ABSTRACT

There is growing evidence that simultaneous to the Revolution in Military Affairs (RMA), a less obvious, but equally profound, Revolution in Military Logistics (RML) has occurred that shapes and underpins western military effectiveness. However, there has been no conceptualisation of this RML nor its wider effect on Western force structures. This article addresses this gap in the security literature. Using an interdisciplinary literature review and case studies, it makes two central contributions: first, it details how western military logistics systems and practises have transformed following post-Fordist principles in the last two decades. In doing so, second, it contributes a major new conceptual framework to the military logistics and security studies literature. Finally, the implications of these processes for military effectiveness are examined, with the conclusion asserting that the cumulative effect of this post-Fordist RML has potentially increased western militaries' strategic vulnerability.

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Amateurs study strategy and tactics, professionals study logistics. (General Omar Bradley)

Introduction¹

Strangely, for a practice that profoundly impacts military effectiveness and hence global security, there is general consensus that military logistics remains understudied (Kent and Flint 1997, Rutner *et al.* 2012, Kane 2001, Erbel and Kinsey 2018, Yoho *et al.* 2012). While recently both security and logistics scholars have coalesced on the topic (O'Hanlon 2009, Rasmussen 2015, Cowen 2010, 2014, Glas *et al.* 2013, Moore 2019), crucially, the extant military logistics literature lacks any conceptual framework. This article addresses this gap. Utilising an interdisciplinary literature review, and process tracing using doctrinal, primary source and interview data, it offers a post-Fordist conceptual framework for scholars and practitioners to better understand the quiet but profound Revolution in Military Logistics (RML) that has occurred in western nations since the end of the

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Cold War in 1991. Post-Fordism can be defined as the theory that modern industrial production should change from the large-scale mass-production methods pioneered by Henry Ford towards the use of small, flexible manufacturing units, enabled by the complementary organisational principles of centralisation, outsourcing, a core and periphery divide, and networks. The paper makes two major contributions to the military logistics and security studies literature. First, it fundamentally challenges Martin Van Creveld's seminal argument that improvisation, rather than systematic improvements, have dictated logistical successes on modern operations. Second, in detailing how Western military logistics organisation and systems have transformed in line with post-Fordist modes of production, it provides a new conceptual framework for security practitioners and scholars to understand the organisational principles that shape current military logistics.

This paper proceeds in two parts; an interdisciplinary literature review and supporting case studies. First, the literature review analyses the military logistics and post-Fordist literature. This interrogates Van Creveld's seminal text, *Supplying War*, to show how much of it is out of date and, as with the rest of the military logistics literature, lacking conceptual depth. To support the central argument, the review also examines the evolution of business logistics to show how post-Fordist principles have transformed civilian logistics since the 1970s. In part two, the paper first undertakes a case study to contrast post-Fordism with late Cold War (1987–1991) western military logistics. Then, using a case study of predominantly US and UK logistics, it examines how the post-Fordist organisational principles of centralisation, core–periphery, outsourcing, and networking have been introduced to differentiate it from Cold War logistics. The conclusion asserts that such is the scope and nature of this transformation that it has had a profound impact not only on logistics, but on Western military force structures, and ultimately, strategic vulnerability.

Research method and definitions

The paper takes a qualitative, case study approach, long acknowledged in the social sciences as a credible method for both collecting data and concept building (Yin 2014). It applies an existing theoretical framework to a new domain and supports this with data to enhance scholarly understanding of recent developments in military logistics, their implications for the military logistics literature, and to aid practitioner understanding of the processes shaping western military logistics and wider force structures. In doing so, it follows a process tracing “research method for tracing causal mechanisms using detailed, within-case empirical analysis of how a causal process plays out in an actual case” (Beach 2017, p. 1) by locating and detailing the introduction of post-Fordist principles into western military logistics. The supporting evidence has been chosen on an influential case basis (Seawright and Gerring 2008): US, British, and some other NATO militaries are examined as these have been the most deployed Western forces over the past 25 years. These logistics chains have also continually sustained the largest deployments of soldiers in hostile areas of the Balkans, the Gulf and Afghanistan. This paper's emphasis on land forces also reflects the fact that these have been the most heavily deployed and engaged since 2001.

From 2012–2016, primary data was collected from doctrinal, specialist logistics publications and newspaper articles. This data was corroborated with three formal interviews with senior logistics officers responsible for the delivery of logistics capability in the

British Army, an interview with a former Chief of the General Staff (CGS), participation in a British military future logistics workshop, and correspondence with civilian logistics professionals. It was further verified by 12 group interviews of British logistics personnel (over 100 participants) and four field observations of their units in operation, conducted longitudinally over four years. The qualitative data was coded using NVivo software to generate representative themes. Secondary data was collected from multi-disciplinary academic and military journals, and other works on military logistics.

There are numerous definitions of military logistics (Van Creveld 2009, p. 1, Kane 2001, p. 2, Department of Defense [DoD] 2013, Ministry of Defence [MoD] 2015). However, a simple unifying principle unites these definitions: support to military forces synchronised through space and time. In short, military logistics from the ancient to the modern era has always been about getting the required quantity and quality of material and services, to the correct place, at the correct time, and in the correct order, to ensure military forces are as effective as possible. This definition is used here. At the same time, the scope of this article cannot address every element of military logistics, and instead draws on case studies to highlight where US, British and NATO logistics processes and practices have been transformed.

Part 1: interdisciplinary literature review

Military logistics: a lack of theory

Although the period since 2001 has observed intense military activity, and at times heavy media focus on western military logistics failures, only recently have military logistics developments in this period started to receive steady attention from security scholars. This can be categorised as works regarding how logistical constraints influence military strategy and operations; those on national logistics; and those detailing some of the rapid and complex sectoral changes. Works on logistics systems, their geographies, and the constraints they place upon predominantly US force projection and on contractor support in the US and UK are examples of the first group (O'Hanlon 2009, Ortiz 2010, Cowen 2010, 2014, Cusumano 2016, Moore 2019). In the second are detailed analyses of the complex problems within current British defence logistics (Shouesmith 2001, Louth 2015, Bury 2018). Importantly, Shouesmith has noted how this complexity reflects changes in the nature of the modern state. Rasmussen (2015) has argued for closer integration of civilian business strategy and organisation in western militaries to address this complexity. The third category is divided into two. Some argue that "the inherent nature of defence logistics ... has remained constant since the era of ancient warfare" and that "the steps required to construct and operate a logistics system have remained conceptually simple and timeless" (Uttley and Kinsey 2012, p. 405). Conversely, Erbel and Kinsey (2018) argue that an RML has occurred of such importance that without it the renowned Revolution in Military Affairs (RMA) would have been impossible. However, although their article suggested that a new conceptual framework to military logistics was needed, Erbel and Kinsey failed to provide a framework to explain the processes behind the RML. Indeed, while collectively these works indicate that scholars are converging on the topic, they all lack a conceptual framework for explaining the processes behind the recent transformation in military logistics.

As a result, despite other useful contributions (Lynn 1993, Thorpe 1986), Van Crevelde's (2009) *Supplying War* remains the seminal conceptual work on military logistics, with over 1000 citations, thereby completely dominating the field.² It is, therefore, necessary to discuss this in detail here as it establishes the basis of post-Fordism's relevance to military logistics. In it, Van Crevelde investigates logistics in predominantly European land campaigns from the sixteenth century to the 1944 Allied invasion of Normandy. For Van Crevelde, the method of supplying armies during the period 1560–1715 was essentially feudal, based on Ancien Regime society, and in arguing that the military logistics system could not change until society changed, he implicitly acknowledges that military logistics is fundamentally related to modes of production (Van Crevelde 2009, p. 21).

However, somewhat inconsistently, Van Crevelde then challenges the centrality of dominant modes of production to understanding effective military logistics organisation and systems. In his most controversial chapter examining the Allied logistics plan for Operation Overlord, Van Crevelde states it did not survive contact with the beaches, and that improvisation was again resorted to (p. 211). Indeed, for Van Crevelde, improvisation defines successful military logistics. Despite an acknowledgement of the need for preparation, Van Crevelde's central – and counter-intuitive – argument is that preparations' impact on operations is limited and does not always equal success. He states that flexibility, resourcefulness and determination can overcome logistics weaknesses, and in doing so he argues that continuity – in the form of logistical improvisation – is the defining characteristic of military logistics through the ages (p. 203). Decisively, Van Crevelde remains unconvinced that systematic improvement in military logistics is possible as “the results of the only comprehensive effort which was made in this direction [were not] particularly encouraging” (p. 236). This is a contentious position. While it downplays the importance of well-planned logistics systems in military outcomes, it also contradicts the opinions of many modern commanders on the importance of sound logistics preparations (Pagonis 1992, Smith 2007). It can also be argued that Van Crevelde's reasoning is academically nihilistic, for if improvisation is decisive, what is the point of studying military logistics organisation and systems?

In a 2004 post-script, Van Crevelde addresses the potential impact of information technology on military logistics. He correctly identifies how computerisation and Just in Time (JIT) logistics will allow the fine-tuning of logistics capabilities with operational needs, and how modern armies negotiate contracts for services on the free market. However, he then somewhat lazily concludes that there has been no fundamental shift in military logistics since the Second World War as the main method of supply is still predominantly based on road transport and intensive industrial modes of production. Crucially, he states: “It does not appear as if the nature of logistics has undergone or is about to undergo a fundamental change” (Van Crevelde 2009, p. 258). Certainly, Van Crevelde's position that logistical improvisation, determination and flexibility are decisive has some merit: flexibility remains a logistics principle in NATO militaries (Uttley and Kinsey 2012). Van Crevelde is also correct that most supplies are still shipped by road. But his argument about the unchanging nature of military logistics, and the impossibility of systematic improvement in delivery, is questionable.

Despite its original contribution, *Supplying War* has been critiqued by numerous authors. The most sustained of these, Kane (2001), challenges Van Crevelde's position that logistics preparations are “futile”. Examining campaigns from the Second World

War to the onset of the RMA, Kane details how careful attention to logistics planning and execution acted not only as an operational force multiplier, but also how such preparations gave military forces better strategic choices (Kane 2001, p. 111). He, and Erbel and Kinsey, correctly identify that logistics organisation is inherently linked to military effectiveness. And all these authors are correct that information technology will shape future logistics. However, all these works lack conceptual depth in analysing the RML. Van Creveld and Kane lack a conceptual framework for understanding the “quiet revolution” and do not attempt to link it with recent, profound changes in modes of production. Decisively, Van Creveld explicitly states that he is unconcerned with “any abstract theorising” (Van Creveld 2009, p. 3). As a result, his emphasis on improvisation ignores the revolution in western logistics organisation and systems over the last twenty years. His argument that the modes of production are the same as in 1944 is simply incorrect. While Kane’s assessment of the impact of technology is more considered, it leaves open the question of what has changed in the 19 years since his work was published and how this change has occurred. Similarly, Uttley and Kinsey’s arguments about the enduring nature of military logistics principles have been superseded by events: the US, UK and NATO have all since updated their principles in line with the post-Fordist approach (DoD 2012, MoD 2015). Perhaps it is time to examine these changes.

Post-Fordism and the post-Fordist military

The Fordist mode of production – associated with Henry Ford’s production techniques – was characterised by a reliance on mass labour forces “employed on long term contracts, producing standardised products for stable markets under a state-interventionist system of regulation” (King 2006, p. 360). However, this politico-economic mode of production began to be undermined in the 1970s by the pressures of rising production costs and competition. In response to these dual supply and demand side pressures, firms in Japan, and later the US, began to organisationally transform. The central tenets of post-Fordist theory initially coalesced in 1980s in the industrial sociology of Piore and Sabel (1984) and Atkinson (1988), and in the later works of Womack *et al.* (1990), Prechel (1994) and Gomes-Caseres (1996). Collectively, these identified four broad changes in industrial transformation: the centralisation of management control complemented by a simultaneous decentralisation of production processes resulting in flattened hierarchies; the replacement of mass labour with a highly skilled core and less-skilled periphery; the outsourcing of non-core functions; and the development of a network approach to supply and knowledge (Table 1).

While these represent the broad basis of post-Fordist theory, it is important to note that this theory has been highly contested.³ There is disagreement over the exact nature of its tenets and their relative importance (Sayer 1989, Vallas 1999, Hirst and Zeitlin 1991, Prechel 1994, Wood 1989, Sabel and Korn 1991, Harrison 1994, Womack *et al.* 1990), with the “flexible specialisation” school (Piore and Sabel 1984) emphasising increasingly diverse methods of production, and the neo-Schumpeterian school (for example Perez 2002) emphasising the role of information communications technologies. Of importance to this paper’s argument is the debate over the extent of – and relationship between – centralisation and decentralisation (Aksoy and Marhsall 1992, Vallas 1999). However, numerous authors now recognise the simultaneous and interrelated nature of the

Table 1. Fordism and post-Fordism concepts.

Fordism	Post-Fordism
Economies of scale	Economies of scope
Rigidity	Flexibility/responsiveness
Mass production	Small batch production
Dedicated machinery	Flexible machinery
Standardised demand and products	Differentiated demand and products
Just in Case/ large stocks	Just in Time/ minimal stocks
De-skilled workforces	Highly skilled workforces
Vertical integration	Vertical disintegration, horizontal integration

Source: Allen 2004 cited in Ruggunan 2016.

centralisation of management control, and the decentralisation of production processes and lower level decision-making (Kenworthy 1988, Sabel 1989, p. 32, Prechel 1994, King 2006, p. 369). It is also clear that a general consensus has emerged about post-Fordism's overall accuracy (King 2006, p. 367). Indeed, it remains highly useful for understanding the transformation of the organisations and systems underpinning the RML.

While other scholars have examined the impact of New Public Management techniques (Ortiz 2010, Eckerd and Snider 2017), King (2006) has utilised post-Fordism to describe ongoing transformation in Western militaries. He argues that modern Western militaries have transformed in a fashion analogous with post-Fordist industry due to similar "supply and demand-side pressures" (p. 368). As a result, special and fully professional forces represent the core, reserves the periphery, and he describes the outsourcing of primarily combat roles to private security companies. Following Sabel (1989) and Prechel (1994), he argues that the centralisation of management control is evident in new joint and transnational military headquarters that share professional knowledge whilst simultaneously and paradoxically decentralising command decision-making, thereby increasing flexibility and flattening hierarchies. This simultaneous process of centralisation and decentralisation has been further proven in his latest work, *Command* (2019). Similarly, the development of a non-linear, dispersed operational approach centred on "empowered" combat brigades capable of operating independently in multinational coalitions indicates the military's adoption of a network approach. Using this evidence, King argues that Western militaries have emulated industry by "institutional mimetic isomorphism" (Dimaggio and Powell 1983). King's contribution is an accurate description of the changes occurring within Western militaries and is perceptive as to why these changes are occurring. In showing how dominant modes of production and economics are important sources of Western military transformation, he explicitly links military change with industrial and economic change. However, King's focus remains on combat forces. Thus, the question remains if Western military logistics – presumably under similar, if not more intense, economic pressures than combat forces – have transformed in a similar post-Fordist fashion?

Post-Fordist industrial logistics

In order to understand the dramatic change in how military logistics is delivered since the Cold War, it is important to firstly examine industrial logistics. This is vital to highlight how the reciprocal relationship between military and industrial logistics has changed over time, with industry in the ascendancy in the current era. It also establishes the foundation for the

post-Fordist conceptual framework advanced later. Charting the evolution of logistics thought, Rutner *et al.* (2012, p. 97) posited that while the practice of logistics originated in the military, “civilian logistics and supply chain management surpassed military logistics at some point after World War II”. This view is supported by Kent and Flint (1997), whose analysis of the industrial logistics literature described its evolution in six key phases. The first phase is farm to market logistics which describes the transfer of goods from point of production to point of sale. By the start of the Second World War, they argue that this era had been largely eclipsed by “segmented functions” logistics. The primary focus at this time was on the functions that distributed goods, with heavy emphasis on in-bound out-bound transportation, warehousing, wholesaling and inventory control, coupled with a reliance on the combustion engine to produce greater efficiencies (Kent and Flint 1997, p. 23). This has been described as the Fordist logistics model, based on a static supply chain “in which the manufacturer contracts with a supplier to make and deliver material to the facility, where it is stockpiled” (Simon 2001, p. 63). Kent and Flint argue that this era was heavily influenced by the military logistics practices of the Second World War that continued to be utilised by industry until the early 1960s. Similarly, Rutner *et al.* (2012) see the US Army’s use of rear logistics bases in the European theatre as the “precursor to the modern distribution centres used by the world’s largest firms” (p. 102). For these authors, the military provided the impetus for change in industrial logistics, highlighting how military logistics was at the vanguard of logistics thought until the early 1960s. Crucially, the main body of Van Creveld’s analysis is based on evidence from this era and as a result, this is where the utility of much of his contribution ends.

Kent and Flint argue that the era of segmented functions was followed by the development of “integrated functions” in the early 1960s. This describes the trend toward viewing independent logistics functions holistically as part of a wider, interdependent system. During this period, as the business environment became more dynamic and competitive, there was a shift in emphasis from physical distribution to a “total cost” approach to all parts of the logistics process, with a growing emphasis on information systems, services, marketing, and a wider realisation that one size of product did not fit all. This era coincided with the beginnings of post-Fordist modes of production, and these developments were advanced during the subsequent era Kent and Flint term “customer focus” in the 1970s and 1980s. This involved a shift in primary focus toward the end user of the product, and toward maximising profits rather than minimising costs. Link node concepts of logistics, and greater emphasis on operations management and management science also emerged during this era.

With the onset of the eras of “logistics as differentiator” and “behaviour and boundary spanning logistics” in the 1980s, the relationship between industrial logistics and military logistics inverted, driven primarily by new information technologies. The realisation that information technology could support highly synchronised JIT logistics systems to increase commercial returns first originated in the production practices instigated by Toyota during the mid-late 1970s in response to inflation and a stagnating Japanese economy (Womack *et al.* 1990). Reducing waste – in the form of stocks, workforce, and production times – was the crucial motivator for the introduction of these practices. The basic premise of JIT holds that “no product should be made, no component ordered, until there is a downstream requirement” (Christopher 1998, p. 179). A central tenet of JIT logistics is Supply Chain Management (SCM). SCM views the procurement,

supply and distribution functions as a single system, and aims to “establish control of end-to-end process in order to create a seamless flow of goods” (Christopher and Holweg 2011, p. 63). Utilising information technology to increase control of the total supply chain reduces costs and increases profitability. And with better control, the supply chain is more flexible to respond to changes in supply or demand. However, it is important to note here that the SCM approach is based on relatively stable assumptions of demand and supply that reflected the relatively stable strategic and market environment during the Cold War. As a result, SCM systems are dynamically flexible, but “only within the set structure of their existing supply chain design” (Christopher and Holweg 2011, p. 64).

Coupled with a greater understanding of the benefits of inter-organisational efficiency and reverse logistics within an increasingly globalised economy, SCM’s cross-functional approach was central to the new JIT logistics procedures that were adopted by Japanese and US firms in the early 1980s. Meanwhile, changing customer demands encouraged out-sourced production and services to allow firms to respond to market demands (Mentzer *et al.* 2004, p. 620). Rutner *et al.* have also identified how the deregulation of the transportation industry in the US and a growth in mergers of US firms began the trend toward decentralised organisational structures and flatter hierarchies in wider industry (2012, pp. 107–108). At the same time, logistics became central to production operations; streamlined and efficient logistics systems were viewed as decisive in conferring competitive advantage. Kent and Flint show that recognition of this principle continues to grow today, and that an understanding of the benefits of co-operation between firms is leading to greater inter-firm and inter-functional cooperation and coordination of logistics efforts to increase both efficiencies and flexibility (1997, p. 26). The underlying motivation for all these changes is that strategic networks across the entire supply chain allow organisations to better adjust to changing customer demand whilst limiting costs.

It is clear that modern business logistics have transformed in the last 30 years as the global economy and modes of production have evolved. It is also clear that the nature of the isomorphic relationship between military and industrial logistics has shifted since the Second World War. Moreover, there is an identifiable time-lag between the introduction of new business logistics practices, their appearance in industrial logistics publications, and then their adoption by military logisticians (Rutner *et al.* 2012, pp. 98–102, Kent and Flint 1997, p. 24). Thus, since the 1960s Western militaries, isolated from the industrial world and protected from market competition, have been slower to change their logistics practices than commercial firms. While this fact is important in explaining the beginnings of recent Western military logistics transformation, it should be noted that the different nature of military logistics – where military effectiveness is the ultimate standard by which success is judged, not efficiency – also played an important part in slowing the introduction of post-Fordist techniques, as did stockpiling to increase resilience. However, in time these would come to be seen as detrimental to both military effectiveness and efficiency.

Part 2: case study 1: the legacy of Cold War military logistics

During the Cold War (1947–1991), NATO’s strategy for deterring Warsaw Pact forces was based around the positional defence of Central Europe. This saw a significant proportion of combat forces based in forward positions in West Germany in order to fight a

conventional, high intensity defensive war. These forces were to be supported by reinforcements held at varying degrees of readiness moving to predetermined positions in a “layer cake” defensive plan, as shown in [Figure 1](#). Crucially, each nation was responsible for logistics in their own sector, and each sector utilised linear lines of supply. To sustain such large, forward-positioned forces, NATO accepted stock levels were for 30 days of combat supplies. As a result, formations such as 1 British Corps organised their logistics organically at successive levels using the traditional “echelon system”, with stores held at frontline units, then forward storage sites, then at rear depots and finally larger quantities held in storage in locations such as Antwerp (Moore and Antill 2000,

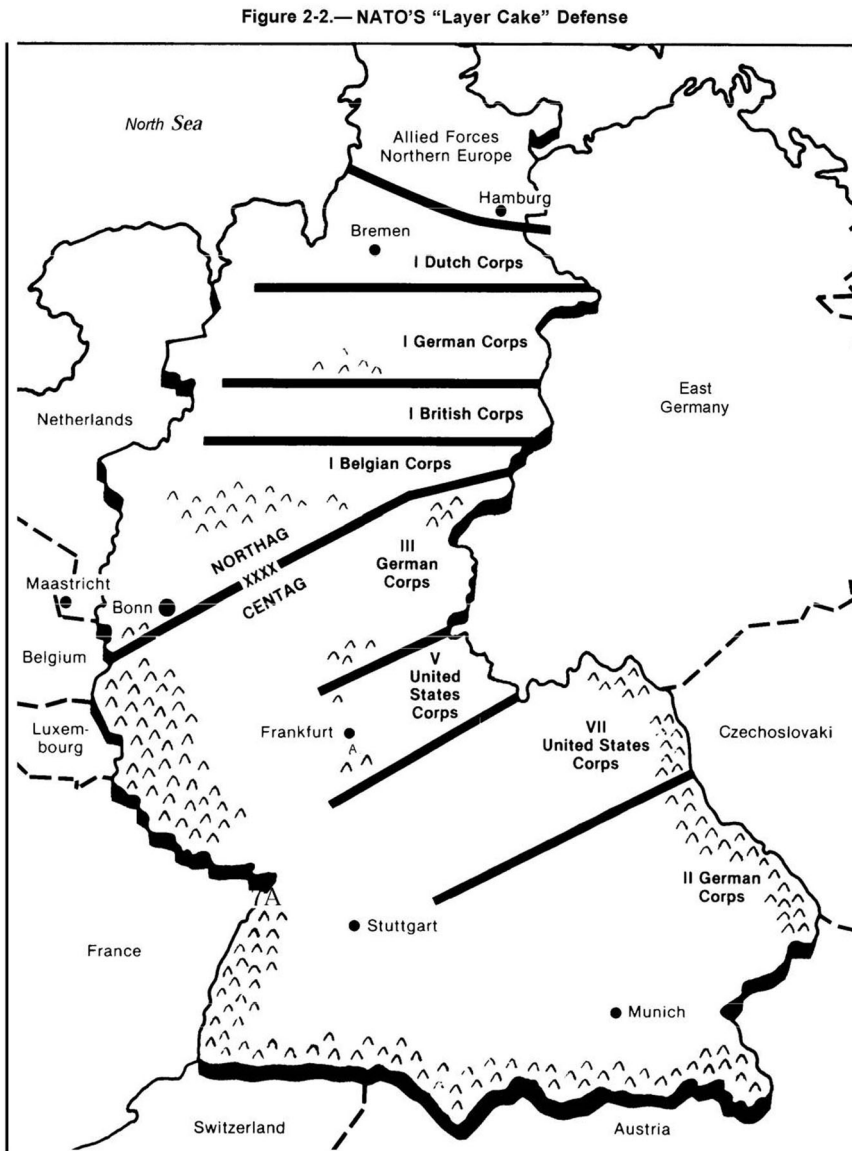


Figure 1. NATO ‘layer cake’ defensive plan.

p. 67). This structure meant that in the event of hostilities, the main logistics plan was based around the forward movement of stocks, with combat forces' controlled withdrawal along predetermined lines of communication gradually reducing supply lines. NATO's strong understanding of the Warsaw Pact's doctrine and tactics thus shaped its pre-determined defensive and logistics plans. Moving pre-arranged levels of stock forward at pre-arranged times along secure lines of communication in rear areas meant that there was little need nor desire for complicated asset tracking or inventory management systems, while the logistics structure itself remained functionally segmented with little integration of resources or joint planning (Moore and Antill 2000, p. 67). Indeed, the Chief of the General Staff, General Sir Nick Carter, eloquently surmised the nature of warfare and logistics at this time:

When I grew up in the Cold War, it was straightforward. We were at four hours' notice to move, we sat in our barracks in Germany, we knew where all our equipment was, we knew where our deployment positions were and we were ready to go for a very clear and present threat that we understood. (*The Daily Telegraph* 2015)

In short, notwithstanding differences in the availability of strategic airlift and force posture, the logistics system of NATO in the Cold War was similar to that of the Allies during the European campaign of 1944–1945 in that it was predominantly reliant on depots, trucks, and the segmented functions approach.

Western military logistics in the 1991 Gulf War remained organised around the Cold War echelon system. Although the campaign was expeditionary, the coalition could build-up forces in secure areas away from the frontline in Kuwait. These forces were likewise supplied by secure logistics bases and lines of communication, and combat operations were directed against a linearly deployed conventional enemy (the Iraqi army) using defensive tactics to hold national territory. Due to this operational reality, the US logistics system operated out of the Saudi port of Jubail, through Al-Qaysumah base, and then moved goods onto divisional logistics bases. To keep 700,000 US troops supplied, 18 trucks per minute, 24 hours a day, seven days a week passed on the main supply route (Pagonis 1992, p. 9).

Nevertheless, the overarching impression of the US logistics operation given by the officer responsible, Lieutenant General William Pagonis, is of a logistics system struggling to sustain such large forces in the desert. Contrasting the prevalence of RMA combat technologies, Pagonis notes that the lack of asset tracking systems resulted in massive unused stockpiles, and that the whole logistics plan was still recorded in paper format in a single "red book" binder (Pagonis 1992, pp. 104–106). Pagonis also tells how he had to develop logistics planning cells to assess requirements, analyse activities and draw up contingency plans, indicating that these cells were an innovation rather than determined by doctrine. While there were early signs of some post-Fordist thought in western military logistics at this time, it is clear the Cold War model still applied.

The British experience paints a similar picture. General Rupert Smith has stated that their logistics plan struggled to supply 1 UK Armoured Division in the Gulf and may have not survived contact with a more competent enemy (White 1995, p. 23). The British Army's logistics plan followed Cold War doctrine in its adoption of echeloned rear bases and three lines of supply to support a linear battle. A single theatre supply area, known as the Force Maintenance Area (FMA) was initially established at Jubail,

and supplies were to be trucked to a Forward Force Maintenance Area (FFMA), and then to a Divisional Maintenance Area for distribution to frontline units along secure lines of communication. Just In Case (JIC) logistics – an inventory strategy of keeping large inventories on hand to minimise the probability of running out of stock – was still practised, with the FFMA stockpiled with enough supplies to sustain the division in combat for at least 10 days (p. 9). However, the UK logistics effort suffered from poor inventory and asset tracking procedures, with stores held in depots in Germany since the end of the Second World War frequently missing or unserviceable (p. 20). Meanwhile, the mechanical spares system was “overwhelmed” due to a lack of asset tracking systems (p. 151). Asset tracking was a major flaw across British logistics, with a single officer forced to examine every container at Jubail to find critical medical supplies (p. 94). Movement control IT systems were also incompatible: in the words of one British logistics officer this resulted in manual information gathering “using stubby pencil, T cards and the most famous ... computer of all, fagpacket [becoming] the day to day tool of the mover” (p. 67). Smith highlights how many ships were loaded to capacity to reduce costs rather than in the order their stores were needed, thus hampering tactical flexibility.

The Gulf War highlighted that western military logistics were still fundamentally based on the echelon system of re-supply in secure rear areas and JIC stockpiling practices. The same system was followed in the US and UK deployments on NATO’s Balkan missions, and the British deployment to Sierra Leone. Indeed, it appears that the gap between industrial and military logistics during this period was at its widest, and despite attempts to centralise logistics command with development of the joint-force US Transportation Command (USTRANSCOM), functional segmentation remained high. US and British military logistics organisations had been insulated due to large budgets and the need to counter a single, constant existential threat in the Cold War. But by 1999, with shrinking budgets and the desire for a smaller, more globally deployable military to address increasingly diverse threats, it became increasingly obvious that their logistics organisation and systems were far behind the curve. In February 1999, the UK began centralising logistics in its new Defence Logistics Organisation, whose main tasks were to streamline defence logistics structure, reduce stock costs and manage procurement reform (House of Commons 2000). In the US that same month, a military commander called for a distribution-based “Revolution in Military Logistics” (O’Konski 1999). Heeding this call, the US Department of Defense launched a “Logistics Transformation Plan” in order to modernise logistics (DoD 2000).

Despite these early attempts to reform, the 2003 Iraq War highlighted major shortcomings in both nations military logistics systems. These failures became embedded in public perceptions, with headlines such as “Families of dead soldiers can sue MoD over inadequate kit”; “US soldiers lack best protective gear” and “Thousands of Army Humvees Lack Armor Upgrade” highlighting media interest (*USA Today*, 17 December 2003; *The Times*, 20 October 2012; *The Washington Post*, 12 February 2007). Reacting to public concern, a House of Commons inquiry into British preparations for the invasion of Iraq noted that as: “a result of a combination of shortages of initial stockholdings and serious weaknesses in logistics systems troops at the frontline did not receive sufficient supplies in a range of important equipment including enhanced combat body armour ...” (MoD 2004, p. 4). A British Commanding Officer during the initial war fighting phase went further, describing the delivery of logistic support to frontline operations as

Table 2. Fordist and post-Fordist military logistics.

Fordist (to 1991)	Post-Fordist (1992+)
Numerous commands and headquarters	Centralised rationalisation of commands and headquarters
Centralised, hierarchical and non-flexible supply and decision-making	Decentralised, flatter and flexible supply and decision-making
Echeloned supply system	Nodal networked supply system/echelons compressed
Rear depots	Forward bases
30 days supplies (Just In Case)	10 days supplies (Just In Time)
Forward movement of stock on secure linear supply lines	Distributed insecure supply lines
Linear battlespace	Non-linear battlespace
Analogue logistics plan and data recording	Digitalised logistics plan and data recording enabled by SCORM
Limited asset tracking	Digitalised asset tracking (MJDI)
Organic military ownership	Functions outsourced to contractors
Capability maintained in regular forces	Capability outsourced to periphery reserve forces
Limited specialisation of core personnel	Professionally trained and educated core

“woefully inadequate” (Yoho *et al.* 2012, p. 85). The impact of the failure of unresponsive “brute force” logistics based on JIC principles was not only felt by British troops. A US Congress investigation found that in the first month of combat operations, the defense department temporarily “lost track of \$1.2 billion in materials shipped to the Army, encountered hundreds of backlogged shipments, and ran up millions of dollars in fees to lease or replace storage containers because of backlogged or lost shipments” (*Federal Times*, 9 May 2005). Other inefficiencies identified included port congestion, improper sequencing of combat units and their support, excess costs and the disrupted flow of units and supplies into theatre (Simon 2001, p. 64). Clearly, western military logistics were failing, and the perception was they were failing because they had not adopted industry best practice. As the conflict in Iraq continued, the need for more cost-efficient logistics became increasingly important. A real RML was needed, and the American and British militaries began to transform their logistics systems to emulate post-Fordist industry (Table 2).

Case study 2: post-Cold War, post-Fordist military logistics

Centralisation and decentralisation

The presence of neo-liberal governments in the US and UK committed to outsourcing state functions to industry to generate efficiencies is important in understanding the wider drive for military logistics efficiencies. Similarly, the RML could not have taken place without a vast increase in computing and information technology capacity. But, more specifically, the media coverage of early logistical failures in the invasion of Iraq and the resulting political pressure to address the issue ahead of presidential elections, forced US Secretary of Defense Donald Rumsfeld to prioritise logistics transformation. The first of these changes, the centralised rationalisation of headquarters, began in the early 2000s and was largely complete by 2015. In September 2003, Rumsfeld began the process of centralisation of management control, designating Commander USTRANSCOM as responsible for all distribution across US defence. Rumsfeld directed the organisation become “the single entity to direct and supervise execution of the Strategic Distribution system” in order to “improve the overall efficiency and interoperability of distribution related activities – deployment, sustainment and redeployment support during peace

and war” (Mann 2010). Rumsfeld had experience of transforming ailing businesses by streamlining procedures and reducing workforces in line with post-Fordism, and his initiative was informed by his awareness that the management control of the entire US defence distribution pipeline needed to be properly linked and synchronised to produce cost-effective supply. It had to emulate industrial logistics by incorporating information technologies into newly centralised organisations and systems.

To this end, the reforms designated USTRANSCOM’s four-star general as the single, unified commander for all defence distribution, and outlined a four-year plan to change organisational structures and upgrade IT systems to give complete oversight of the distribution system. Paradoxically, enabled by centralised, standardised IT systems, the decentralisation of decisions throughout the distribution pipeline encouraged the flexibility to respond quickly to frontline demands (Smith 2007, p. 92). The centralisation of control and standardisation of logistics under USTRANSCOM continued in 2006 when it was made responsible for identifying, recommending and supervising implementation of all global sourcing solutions (Smith 2007, p. 97). Importantly, at this time USTRANSCOM adopted the civilian Supply Chain Operations Reference Model (SCORM), which is a process model that identifies core institutional activities and tailors production-supply chains to meet these processes (Maddox 2005, p. 5). It is considered the cross-industry standard strategy, performance management, and process improvement diagnostic tool for SCM.

The British military also increased centralised rationalisation in response to the shortcomings of Iraq. In 2004, the Defence Logistics Transformation Programme (DLTP) was launched with the aim of increasing the effectiveness, efficiency and flexibility of logistics support across UK defence, appointing the first Chief of Defence Materiel. The DLTP began the process of rationalising defence materiel and resources and created larger centralised centres for the repair and maintenance of weapons platforms than previously existed. While the DLTP did increase effectiveness with the introduction of centralised whole fleet management and asset tracking systems, it was primarily centred on cost-reducing efficiencies, and, supported by consultants at McKinsey, eventually delivered savings of £952 million (McKinsey 2010). A renewed focus on efficiency came with the 2006 Defence Logistics Programme. This sought to increase coherence, velocity and precision across logistics through the centralisation of command and control, and the updating and centralisation of IT systems (Leeson 2006). Emulating the US, 2007 saw the merger of Britain’s two defence logistics organisations into a single entity, Defence Equipment & Support. Following (King 2006), operational logistics was also centralised in the Permanent Joint Headquarters J4 division and within the theatre-deployed Joint Force Logistic Component Headquarters (MoD 2012, p. 6). Meanwhile, a single centralised inventory system for the whole of UK defence, the Management of Joint Deployed Inventory (MJDI), was commissioned to provide one platform to link previously incompatible asset tracking systems and facilitate decentralised and flexible logistics decision-making. NATO logistics command has also begun centralising headquarters, although at a much slower pace. In 2011, member states agreed to reduce and reorganise the alliance’s logistics structure into the NATO Procurement and Support Agency. This combined four former NATO logistics commands into one. Clearly then, the US, UK and NATO have centralised their logistics commands, organisation and systems in line with post-Fordism.

Integrating the core and the periphery

As with the combat arms, a core, specialised logistics workforce is being established in Western militaries. Enabled by better training and technology, these core logistics organisations are professionalising the study and practice of logistics. Highlighting a major shift in institutional goals, this new core is specialising in the management of logistics IT systems and contracting. For example, the US Army's Materiel Command is expanding the training of its in-service contracting professionals to increase the army's capability to understand and engage with its contractors (Dunwoody 2011, p. 84). The establishment of a Logistics Contract Management Course in the Defence Logistics School indicates that British forces are following suit (British Army 2014). In a further sign of specialisation, the US Army consolidated previous logistics learning environments by opening its own logistics university in 2009, which runs over 200 specialised logistics courses. Similarly, the introduction of MJDI in the British Army will be enabled by the creation of a specialist unit to support higher command. The full roll-out of MJDI will also flatten traditional hierarchies, with new core Logistics Support Detachments (LSDs) embedded with each unit. These detachments will consist of a team of four "professional logisticians" and will replace the old system of each unit providing their own non-specialist logistics staff (British Army 2014, para 70). This smaller, core LSD will significantly reduce the number of logistics-related personnel in each unit, and will deploy with its parent unit, resulting in significant changes to the way army units are supported. Meanwhile, the UK, US and NATO have also been careful to maintain core logistics functions deemed central to operational effectiveness. The post-Fordist focus on the core, then, has utility.

Simultaneously, due to defence cuts, the US and Britain have had to sharply reduce their logistics force size whilst attempting to maintain their effectiveness. These cuts have often focused on the logistics component precisely because it is perceived that much of the non-core capability can be provided by a periphery workforce (*The Daily Telegraph*, 31 March 2012). To reduce costs, expensive and traditional logistics functions needed during large mobilisations have been allocated to reserve forces, which have been increased in size in a bid to maintain capability (Bury 2019). For example, while the Army 2020 reforms reduced the British Army's logistics personnel by about 30 percent, the complementary reform of the Army Reserve has increased reliance on reserve logistics units to meet surges in demand, and led to the creation of many new reserve logistics units (British Army 2014, para 80). While the UK's reserve logistics component has therefore been increased, the capabilities it provides have generally remained toward the lower end of the skill spectrum. Those units that do have a more specialised function have been formed with the specific aim of incorporating previous military or civilian skills into current capability to reduce costs. This delegation of lower skilled logistics functions to reservists, coupled with the desire to tap the specialised ex-military or civilian workforce, indicates the dual nature of modern military logistics' structural reliance on the periphery.

However, both the centralisation of command, the simultaneous decentralisation of processes and the division of labour between the core and the periphery have been complemented by the adoption of the "total cost" approach to force structure and readiness in western militaries. The closer integration of the core and the periphery is underpinned by the total cost approach, supported by SCM practices that strive for the flexibility to

respond to consumer demands whilst keeping running costs down. British defence is currently being re-organised around the “Whole Force” concept. This is focused on ensuring that the product – which in the military sense is manpower – consists of “the right mix” of “Regulars, Reserves and Contractors to produce the greatest effect in the most cost-effective manner” (MoD 2014). By achieving a more “balanced mix” in the future UK defence planners hope to retain capability and flexibility whilst decreasing expensive manpower costs. In particular, the logistics element – the new Total Support Force (TSF) – will comprise a “pre-planned mix of military, civil service and contractor personnel held at appropriate readiness to provide progressive levels of support in the UK and on operations” (British Army 2014, para 39). However, the pervasiveness of SCM goes beyond mere logistics. In Britain, the Whole Force concept has been implemented through the Army 2020 restructuring policy. This is reliant on operational planning assumptions, tiered levels of force readiness, rotating major units through a new readiness cycle, and better trained, equipped and integrated reserve forces. As such, the entire structure of the British Army, and how it envisages it will be used on operations, has been rethought to address supply and demand side pressures using SCM principles.

In 2012, the US Army also instigated the “Total Force” policy aimed at better integrating the Army, National Guard and Army Reserve components below the divisional level. Specifically, these reforms standardised reserve readiness with those of the army (US Army 2012). Under analogous fiscal pressures, and following advice from business management firm Price Waterhouse Coopers, the Irish Defence Forces also introduced a “Single Force Concept” in 2012. Germany, France, and NATO have not yet adopted the concept, predominantly due to ongoing reserve transformation in the case of the former and political issues in the latter two, but the recent adoption of the “total cost” approach by some Western militaries represents a profound change in the way in which not only their logistics, but also their wider military forces, are organised, resourced and deployed. In the US and UK, the change has occurred in a similar time frame due to similar budgetary pressures and strategic appraisals. While the total force approach, therefore, has implications for military logistics, the force structure solutions they provide are based on post-Fordist principles. Coupled with the centralisation of logistics commands and the division between core and periphery logistics functions, the adoption of the integrative “total cost” approach in Western militaries signals the end of the segmented function logistics of Van Creveld’s era (Table 3).

Table 3. Applied processes of post-Fordist military logistics transformation.

Centralisation	Core – periphery integration
US Transportation Command (2003)	US Material Command training (2011+)
US Supply Chain Management (2003)	US Army Logistics University (2011)
UK Defence Logistics Transformation Programme (2004)	UK Logistics Contract management Course (2012+)
UK Defence Logistics Programme (2006)	UK Logistics Support Detachments (2012+)
UK Defence Equipment and Support (2007)	UK Future Reserves 2020/30 (2013+)
UK Management of Joint Deployed Inventory (2012+)	US Army Total Force (2012)
NATO Procurement and Support Agency (2011)	UK Total Support Force (2014+)
SCM and outsourcing	Networked supply
UK SCM (2003+, with McKinsey)	UK Joint Defence Publication 4.0 (2015+)
UK Joint Supply Chain (2005)	UK Management of Joint Deployed Inventory (2012+)
UK Total Support Force (2014+)	UK Total Asset Visibility Minus (2012+)
US (Joint Supply Chain Architecture (2007+)	UK Defence Support Network (2015+)
US, UK Increased use of logistics contractors (2003+)	US Global Combat Support System (2016+)
NATO SCM (2012)	US Army Enterprise Systems Integration Program (2016+)
US, UK, NATO Performance-Based Logistics (2008+)	

SCM and outsourcing

The success of the total cost approach relies on two decisive criteria being met. Firstly, there must be a comprehensive understanding of demand, and secondly, there must be an understanding of how this demand will be met. Forecasting and supply are thus crucial. At the strategic level, Western military logistical demands are set by force structure and strategic appraisals, such as the Strategic Defence and Security Review and the Quadrennial Defense Review. At the operational level, currently, logistics forecasting is still demand-based, having changed little since the Second World War. However, the supply side has changed dramatically with the introduction of SCM principles and systems into military logistics. Indeed, without the transparency and oversight of supply encouraged by SCM, the integrated total force concept would fail.

British logistics practices are now heavily dependent on SCM systems. After the 2003 Iraq deployment, McKinsey was heavily involved in introducing SCM procedures across British defence, with a particular focus on increasing delivery reliability whilst decreasing wait time. Numerous procedural inefficiencies were identified, along with the need to update IT systems. One of the most noticeable changes under the SCM approach occurred in relation to unit stores. Under the previous segmented approach, units held 30 days of stores in contingency. However, by linking demand data with engineering analysis and the experience of quartermasters, standard stores and bespoke “priming equipment packs” are now kept within the supply chain, giving far more flexibility (McKinsey 2010, p. 54–5). Reflecting the desire to move to a wider SCM footing, in 2005 the Joint Supply Chain concept was introduced by the MoD to “cover the policies, end-to-end processes and activities associated with receipt of stocks from trade to their delivery to the demanding unit and the return loop for all 3 Services” (MoD 2012, p. 3).

Similar changes have been underway in the US. In May 2003, the DoD published its Supply Chain Materiel Management Regulation outlining the conduct of future joint logistics. This introduced SCORM, and at its core was an awareness that US defence logistics needed to be more responsive, reliable and consistent to adapt to the evolving global environment whilst delivering the best value for money. In 2007, the first of three phases in the introduction of SCM, the Joint Supply Chain Architecture was initiated, and in 2010 it was institutionalised (Fletcher 2011). The most recent manual on SCM procedures instructs the military to “monitor and adopt or adapt emerging business practises to provide best-value, secure materiel and services, improve DoD supply chain performance, and reduce total life-cycle systems cost” (DoD 2014, p. 7) The US military thus clearly aims to continue to emulate industry to increase efficiency. While NATO is yet to adopt a total force structure or a full SCM approach, its updated logistics principles indicate the impact of SCM concepts on its doctrine (NATO 2012, pp. 50–51).

The SCM approach relies on the outsourcing of production to meet demand and increase efficiencies, and recent NATO, US and British logistics doctrine places much emphasis on the role of outsourced defence contractors on operations. NATO doctrine states that the use of contractor support “ensures the most efficient and effective use of resources” and offers “a useful force multiplier tool” (NATO 2012, p. 157). Indicating the growing desire to utilise outsourcing, its doctrine dedicates an entire chapter to standardising the use of contractors across the Alliance. The evolution of the US Army’s Logistics Civil Augmentation Program (LOGCAP) provides another good example of the shift

from organic military logistics toward outsourcing. Introduced in 1985, its objective is the institutionalisation of planning procedures to enable “civilian contractors to perform selected services in wartime to augment Army forces” (US Army 1985, p. 1). LOGCAP’s focus is support to contingency operations, and outsourced services include the whole spectrum of basic life support (BLS) activities on operations, including billeting, catering, repair and maintenance, sanitation, mortuary affairs, information operations and ammunition management, amongst others (US Army 1985).

Interestingly, LOGCAP contracts were initially centralised, with either Kellogg Brown Root (KBR) or Dyncorp winning the first three contracts to provide all services. These contracts were on a cost-plus-award-fee basis and totalled up to \$900 million (Department of Defense 1999). Emulating the Army, in 1997 the US Air Force instituted its own AFCAP (*Global Security undated*), with the Navy also introducing its Global Contingency Services Contract. Contracts for BLS services provided under the KBR-won LOGCAP 3, signed in 2001, saw the company receive \$39.5 billion in Iraq-related contracts alone between 2003–2013 (*International Business Times*, 19 March 2013.) Following criticism of KBR’s performance during the wars in Iraq and Afghanistan under LOGCAP 3, and accompanying allegations of corruption, (*New York Times*, 17 June 2008), Army Material Command decided to increase competitiveness. LOGCAP has since switched to smaller, multiple “task orders”, with 2019s LOGCAP 5 awarding \$82 billion to 4 major contractors: KBR, Fluor, PAE-Parsons and Vectrus Systems.

Numerous scholars have discussed western militaries’ increased reliance on outsourced contractors in detail (Ferris and Keithly 2001, Avant 2005, Kinsey 2005, Ortiz 2010, Cusumano 2016) but it is important to note the nature of LOGCAP contracts here. In his excellent survey of US logistics outsourcing, Moore (2019, p. 4) highlights that the ratio of contractors to uniformed logistics personnel was roughly 1:6 in the Vietnam War but was as high as 5:1 in Iraq. More broadly, between 2001 and 2010 at least one civilian contractor was hired for each deployed US service member during the campaigns in Afghanistan and southwest Asia; 82% of these contractors were not US citizens (Sheverak 2010, p. 57). For example, in 2007, at the height of the Iraq war, the US military directly or indirectly employed 180,000 contractors, while it had 160,000 troops in theatre (*Los Angeles Times*, 4 July 2007). Of the contractors, 21,000 were American, 43,000 were foreign and about 118,000 were Iraqis (Sheverak 2010, p. 57).

Coupled with the outsourcing of logistics capability to reservists (Bury 2018), the British Army’s new TSF places a similar emphasis on logistics contractors. Crucially, the new structure states that: “the use of non-military personnel will [provide] most if not all logistics functions rear of the Theatre Support Group by route 4 of an enduring operation” (British Army 2014, para 45). Therefore, the British Army’s doctrine is to delegate rear logistics functions to the private sector by the second year of a deployment. This doctrine also states that reliance on Contractor Support to Operations will increase in ratio as the army decreases in size due to cuts (para 38). It states that early engagement with long-term contractors during operational planning is required, and that contractors should be included in the whole spectrum of these plans, from force generation, to deployment, sustainment and force protection. That outsourced contractors are now involved in military planning is a significant change in the traditional relationship between industry and the military.

While the scale of contractor support to the US and British militaries in Iraq and Afghanistan was politically useful as it meant troop caps could be circumvented in these

unpopular wars (Cusumano 2016), it nonetheless points to a massive commercialisation and civilianisation of the logistics function. Meanwhile, the fact that the second and third largest winners of US contracts in Iraq were both Kuwaiti firms, and that contracting in Afghanistan had to be re-organised due to corruption allegations, (*International Business Times*, 19 March 2013; *The Boston Globe*, 30 July 2010) highlights how the awarding of contracts to local suppliers also influences reconstruction efforts. In modern conflicts, military logistics – previously undertaken by solely military forces – can be incorporated into strategic goals through their generation of economic activity (Moore 2019, p. 5). No longer confined to sourcing nationally, western militaries have demonstrated their ability to leverage the globalised economy through outsourcing, with major implications for western military strategy.

There has also been a recent transformation in the nature of outsourced contracts. With the support costs of complex weapons systems now exceeding the cost of development and production by two to three times over their service life, others have shown that Performance-Based Logistics (PBL) contracts are becoming increasingly common in Western militaries as a method of reducing these costs. For example, PBL can mean that a civilian firm is contracted to deliver a required amount of flying hours on an airframe, rather than hours of servicing (Glas Hofmann and Eßig 2013). Similarly, analysis of NATO's outsourced contracts in Afghanistan shows that while member states often conducted independent sourcing, pooled operational sourcing was also commonly used (Davids *et al.* 2013). This pooling, sharing and prior negotiation of outsourced logistical services in the US, UK and NATO indicates the increasingly privatised nature of military logistics due to constrained fiscal realities.

The emerging logistics network

Very recently, the focus on the supply chain has been replaced by the realisation that more networked logistics will be a crucially important enabler in future conflict. It is important to recognise here that later refinements of SCM highlighted the importance of networks, and indeed the SCORM approach has also utilised reverse supply chains for many years (Kroon and Vreijens 1995, Geyer and Jackson 2004, Krikke *et al.* 2004, Guide *et al.* 2003). Indeed, even before the introduction of JIT and SCM, US commanders were aware that the ultimate goal of these processes was a “seamless logistics system that ties all parts of the logistics community into one network of shared situational awareness and unified action” (Reimer 1999). As its latest logistics doctrine, Joint Defence Publication 4.0 (JDP 4.) indicates, the British military is now taking steps to move beyond SCM by creating a fully networked logistics system which encompasses more than just the supply chain. Highlighting this, according to one senior officer responsible for transforming British Army logistics, “networking is the new buzzword” (Interview, Senior Logistics officers, 9 June 2015). As JDP 4.0 states, “Logistics stretches across a network of nodes with multiple processes, through which personnel and materiel flow and services are provided” (MoD 2015, p. 9) Thus, the whole British military and accompanying international logistics system is now conceptualised as a “support network” of interconnected nodes of suppliers, consumers, maintainers and storers. This network approach seeks to eclipse SCM by moving beyond the supply chain by simultaneously allowing supplies to be moved “forward and backward and sideways” between nodes. Rather than only moving supplies

forwards toward the end user: “the network spreads the load” associated with potentially stove-piped supply chains by allowing storage within its nodes, thereby reducing logistic drag (Interview, 9 June 2015). Starkly contrasting the logistics overlay of the NATO’s “layer cake”, Figure 2 shows that in a globalised world, it is recognised that the British military supply network must be global. However, this network-enabled capability must be supported by ever more complex IT systems with open architecture across nodes – a situation yet to be reached. To be effective, a fully networked system also needs accurate consumption and environmental data which is largely missing at present. Thus, the British Defence Support Network is still under development; it is not yet a fully networked strategic supply system.

Nevertheless, the introduction of the MJDI and Total Asset Visibility Minus (TAV-) systems across British defence is another example of the emerging logistics network. MJDI will replace the stockpiling and stove-piping associated with segmented function logistics across all units and formations, leading to a networked logistics IT system. It, therefore, will allow for the total global visibility of all stock up to unit level, and therefore better asset management. It will also be inter-operable with TAV- which uses tagged barcodes on vehicles, containers and pallets that can be read by radio frequency. This allows the automatic logging of all supplies as they pass through TAV- nodes, in stark contrast to the experience of the Gulf and Iraq Wars. Such visibility linked with MJDI system will allow demand to be judged in near real-time, and allow logistics planners to move stocks from one unit to another based on priorities rather than solely on the demands of units. Crucially, by “turning every unit into a secondary depot”, MJDI aims to create a distribution network across British defence, with every node in the network able to see what is in

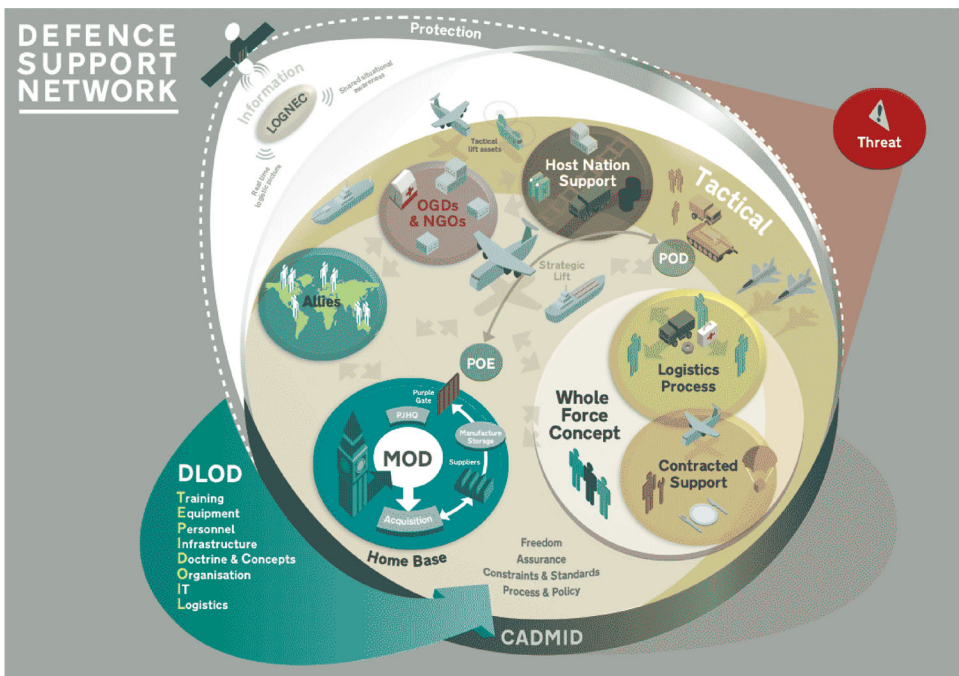


Figure 2. The British Defence Support Network.

the system and where it is at any time (British Army 2014, paras 65–69, 71). Compared to the segmented functions system, MJDI will transform the structure and practise of British logistics, in line with industry best practice. While space precludes a detailed discussion of the operational level manifestation of the network approach to logistics here, it is important to note that contrasting the single theatre entry points of the past, Western nations now prefer multiple entry points to increase both logistical flexibility and resilience to geopolitical issues (*The Washington Post*, 2 July 2010).

Discussion and conclusions

This paper has used complementary case study data to show how the current dominant mode of production, post-Fordism, provides an accurate conceptual framework to understand the organisational and systematic developments that have enabled the RML. In doing so, it makes a major conceptual contribution to a military logistics literature lacking in theory. It is clear that, emulating industry, the US, UK and NATO have transformed their logistics organisation, systems and tactics since the Gulf War. Military logistics has been commercialised and civilianised through the processes of centralisation of management control in rationalised headquarters and the simultaneous decentralisation of production; integrating the core and periphery; outsourcing and SCM; and the emergent logistics network. Enabled by advances in technology, these processes continue to occur, often at different paces and to different extents across these militaries, but all following broadly similar goals and trajectories. With the adoption of the whole system approach to both military logistics and wider force structures it is clear that the impact of each process is heavily dependent on the introduction of the others; for example, centralisation and decentralisation enables networks, networking enables outsourcing. As a result, the total cost approach is creating a logistics system, but also wider western force structures, that rely on high levels of integration to generate the most efficient capability from smaller organisations within tighter time frames. Indeed, the cumulative effect of each of these processes has resulted in the most profound change in military logistics since the introduction of the combustion engine.

This post-Fordist RML has important implications for the military logistics literature. It is patent from the evidence that one of Van Creveld's central arguments – that improvement in military logistics is impossible – is incorrect. That the British and US militaries have improved the efficiency of their logistics since 2003 is beyond doubt. His other major assertion that improvisation is the fundamental characteristic of successful logistics ignores the major impact that networked IT systems, new contracting, outsourcing and core–periphery approaches are having on western military logistics. As much as Van Creveld has given to the study of military logistics, such is the nature of recent logistics transformation that much of *Supplying War* is now out of date and conceptually flawed. Indeed, the next step for researchers interested in post-Fordist military logistics is to conduct theory validation. Further qualitative case studies, or large N quantitative studies, seem most appropriate. Other areas for research concern how cyber developments, such as AI, may be creating new approaches to military logistics organisation that may (or may not) support the Post-Fordist conceptual framework offered here.

At the operational level, artificial intelligence and new technologies such as swarm delivery drones, 3-D printing, high velocity distribution from balloons, automated

convoys and robotic delivery systems, to name a few, are likely to further “challenge the paradigm of the truck” in future military logistics (Interview, 9 June 2015). But at the strategic level, the adoption of JIT processes and the accompanying SCM approach in military logistics has potentially profound consequences for the west especially as block chain technologies are introduced. Kane presciently noted that while JIT “may be a useful slogan for business management ... it is a dangerous philosophy for defence” (Kane 2001, p. 155). While JIT procedures are cost effective and efficient, operational effectiveness is the final and deadly standard against which military logistics systems must be judged. Moreover, coupled with questions over the impact of JIT, there are growing concerns over the wider SCM approach that underpins JIT logistics, and which has shaped western force structures. Christopher and Holweg (2011, p. 63) have argued that, since 2008, ongoing price turbulence across a number of key market indicators has undermined the basic assumptions of SCM. They argue that due to this greater volatility, “supply chain practises may no longer fit the contexts most businesses operate in – primarily because these practises were developed under assumptions of stability that no longer exist”. Although SCM possesses some flexibility, it does not possess the structural flexibility needed to respond to major changes in the market or environment that are occurring in the current era (p. 63).

Whatever the exact relationship between the markets and the strategic situation, it is clear that since the end of the Cold War the world has become less stable. Yet, at precisely the time when complexity and uncertainty are increasing – in the near future some of the most challenging threats will be extreme weather events caused by climate change and pandemics – most Western militaries are downsizing whilst adopting total force concepts and structures in an attempt to maintain capabilities. Clearly, there are advantages to organising integrated forces at tiered levels of readiness, but the re-structuring of these forces is, like the SCM approach the total force concept mirrors, based on relatively stable strategic assumptions of supply and demand, and heavily reliant on a functioning global supply chain that has already been revealed by Coronavirus as sub-optimal in important areas. There is little slack left in this more efficient system. In revolutionising not only their logistics, but also their force structure and readiness around post-Fordist principles, western militaries are potentially more vulnerable to strategic shocks. Indeed, the British military's recent embrace of the Defence Support Network indicates an appreciation of SCM's potential vulnerability identified by Demchak (2003), and Christopher and Holweg (2011). The question now is whether a fully networked logistics system, with enough slack and stockpiles to ensure resilience, can be implemented before the assumptions underpinning SCM are tested. The quiet revolution could yet come undone with a loud bang.

Notes

1. This paper expands on data and arguments which first appeared in Bury (2019).
2. Google Scholar search, 28 May 2020.
3. Post-Fordist critics argue the concept exaggerates the extent of change, makes inaccurate conclusions from limited data, confuses and conflates different processes to simplify social reality and is too optimistic about transitions (Sayer 1989, Vallas 1999, Hirst and Zeitlin 1991, Prechel 1994, Ritzer 1986, Wood 1989, p. 19, 1993, Tolliday and Zeitlin 1986).

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