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Defence logistics: an important research field in need of researchers

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Abstract

Purpose – The purpose of this paper is to provide an introduction to the special issue on defence logistics. To achieve this, an overview of the field of defence logistics is offered together with a discussion of the historical and contemporary issues that have confronted researchers and practitioners. Current research is described, and a research agenda for future work in the field is proposed.

Design/methodology/approach – The paper is based upon a conceptual discussion of defence logistics as it has been studied in the past and is being studied in the present, and a reflection on the ways in which past research can usefully inform future research agendas.

Findings – The paper discusses the current state of defence logistics research, and proposes a research agenda for future work based upon the anticipated characteristics of future combat operations.

Research limitations/implications – A future research agenda is proposed that is informed by recent transformations in the conduct of warfare, as well as through anticipated changes in the global strategic landscape. Comparisons are made between defence logistics operations and their commercial counterparts to illustrate where there may be opportunities for adaptation based on the underlying similarities.

Originality/value – This paper discusses the major threads and themes of defence logistics research as a discipline, highlights the changing landscape of conflict in the 21st century and provides a future research agenda for those working in the field.

Keywords Defence logistics, Military logistics, Business logistics, Logistics, Operations, Warfare, Defence sector

Paper type Viewpoint

Introduction

The purpose of this special issue editorial is to provide an overview of defence logistics research and to offer a research agenda to guide future investigations in this important field. Until the 1960s when the concept of "business logistics" first came into common use, the study of logistics was almost solely focused on the military. Indeed, the word "logistician" is generally thought to have developed from the role of the *chef de lôgis* who was responsible for finding accommodation for Napoleon's troops (van Creveld, 2004) – and, even today, the Oxford English Dictionary defines logistics as

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"the organization of supplies, stores, quarters necessary for the support of troop movements and expeditions".

The North Atlantic Treaty Organisation (NATO, 1997) defines logistics as the "science of planning and carrying out the movement and maintenance of forces" including acquisition of services and the provision of medical and health support. While this definition does not specifically mention the management of external relationships that are considered by many commentators to be a significant logistical function (Christopher, 2011) or the information management challenge (Mangan *et al.*, 2012), it implies that both of these aspects fall within its purview. Thus, what NATO calls "logistics", commerce and industry would increasingly recognize as "supply network (or chain) management". Thus, military communities have adopted the re-labelling perspective of Larson and Halldórsson (2004) and Larson *et al.* (2007) – in other words, when discussing "logistics" they embrace a significantly broader spectrum of acquisition, support and disposal challenges than simply the storage and physical movement of material (and its associated information). However, given that the word "logistics" is firmly grounded in the military vocabulary, it will be retained in this paper – albeit reflecting the broader supply network management concept outlined above.

Defence logistics research: historical and operational

The field of military logistics has advanced along two dominant lines: the historical and the operational. The historical treatment of military logistics typically looks at a particular battle, war, or episodes of armed conflict, and describes the logistical details that led to victory or defeat. This historical tradition includes the seminal works of van Creveld (2004) who spans military logistics "from Wallenstein to Patton"; Engels (1980) who meticulously deconstructs the campaigns of Alexander the Great and reframes the battles of the Macedonian army through the lens of logistics; Macksey (1989) who investigates the impact of innovations in technology, transportation, and administration on military logistics, and the edited volume by Lynn (1994) that offers a critique of van Creveld whilst covering military logistics from the Byzantine era to the American engagement in Vietnam. Though thoroughly rich and extremely useful to all those interested in logistics as a subject of research or art of practice, the military historical tradition is nonetheless struggling to survive within academia (Lynn, 1997).

The operational approach has its roots in operational research (OR) as it was developed during Second World War, with researchers coming from multiple disciplines as there was no field of OR or management science *per se* in existence at that time. Although one of the earliest figures in OR, Blackett (1962), wrote that "operational research is social science done in collaboration with and on behalf of executives", over time the operational approach to military logistics came to be characterized by mathematical methods not unlike parallel developments in the field of economics. Indeed, such mathematical and social scientific approaches continue to flourish alongside one another inside "think tanks" such as the RAND Corporation (RAND) and the Logistics Management Institute (LMI) in the USA where both institutions have maintained vibrant theoretical and applied military logistics research programmes for more than 50 years. What distinguishes operational researchers from professional historians is, however, not just methodology but also the direct dialogue they have with their subject in that the former are suggesting policy approaches or solutions to specific, contemporary problems. Indeed, Klaus (2009) has noted that:

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> [. . .] [l]ogistics, significantly more than other fields, is embedded in a diverse network of intellectual relationships – which also explains the difficulty for logisticians to establish their own, distinct scientific identity.

With this in mind, we anticipate a continuation of defence logistics research being practiced in a variety of different institutional contexts, but with academia and think tanks being the two dominant settings.

Increasing academic interest in defence logistics issues

Research in defence logistics began to appear in peer-reviewed journals in the 1950s, with much of the activity taking place within the confines of the think tanks mentioned above. However, the outputs of this body of knowledge tend to be in the form of monographs and books where the review processes are far shorter than those that are common to social science journals, including those in the fields of management, operations and logistics. That the peer-reviewed journal article has less currency among military decision makers is unsurprising, not least because those commissioning the research are either reluctant to wait two to three years for a report or are uncomfortable with research capacity being taken up writing articles that serve what they perceive to be an academic "observer community" when those researchers could be engaged in other more tactical investigations.

That said, defence logistics research productivity in publicly available, peer-reviewed research journals has increased substantially over the last 60 years. For example, using the terms "military logistics", "defence logistics" or "defense logistics" in the title, abstract, key words or text, we conducted a search of ABI/Inform and Proquest Research Library-Business. This returned a total of 276 peer-reviewed, scholarly, journal articles in the period from 1952 to 2010 (Figure 1).

However, as will be noted from the detailed breakdown in Table I, many of these were published in specialist military journals.

This paucity of published research in mainstream logistics and supply chain management journals is underpinned by a separate review by Tatham (2008) who noted

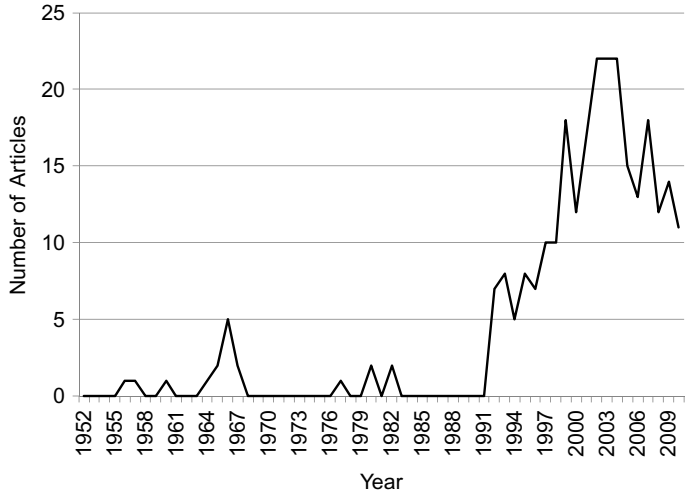

Figure 1.
Number of articles indexed in ABI/Inform Global and Proquest Research Library-Business mentioning "military logistics", "defence logistics" or "defense logistics" in the title, abstract, key words or text from 1952 to 2010

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that of 1,150 articles published in the top five journals rated by Gibson *et al.* (2004) and Menachof *et al.* (2009) in their composite index of logistics research, teaching and outreach "usefulness" during the period 1 January 2000 to 21 October 2008, just nine were focused on defence. Given that the provision of logistics support for any country's armed forces typically represents well in excess of 50 per cent of the defence budget, this relative absence of research in an area of significant expenditure is, at best, surprising. Thus, this special issue of *IJPDLM* is a most welcome step toward invigorating this important research field.

Characteristics of the defence logistics environment

Although business logistics has its "roots in the science of military logistics" (La Londe *et al.*, 1993), and military logistics offers many insights for the practice of business logistics (McGinnis, 1992), we would argue that there are also significant distinctions. First and foremost is that the interest of defence, and by extension defence logistics, is not to maximize shareholder value but to advance the effectiveness and efficiency of the military whose duty is to protect and defend the public interest and long-term security of the State. From a logistics perspective this key distinction that separates the interests of the public from the private sectors, plays out in very profound ways. For example, as outlined by Kovács and Tatham (2009), the logistics support for a country's armed forces is frequently required to operate in a cost efficient mode during peacetime, but then – often at very short notice – must transition to a posture in which effectiveness is paramount and cost a secondary consideration. Thus, the private sector plans and allocates resources to operations in order to achieve "financial outcomes", whereas the defence apparatus plans and budgets operations for "operational outcomes". Second, the environment in which defence logistics is conducted differs in fundamental ways from commercial logistics. Combat, peace support and disaster response operations exhibit much greater degrees of uncertainty across all variables of interest when compared with logistical operations in the commercial sector. Likewise, the demand for resources to support war or disaster response tends to exhibit massive,

Journal name	Number of articles
Air Force Journal of Logistics	65
Management Science	15
Military Medicine	14
Parameters	11
International Journal of Physical Distribution & Logistics Management	10
Journal of Business Logistics	10
Journal of the Operational Research Society	9
Public Administration Review	8
Journal of Public Procurement	7
Journal of Government Financial Management	7
National Contract Management Journal	5
IIE Transactions	4
Interfaces	4
Operations Research	4
The Journal of Military History	4

Table I.
Journals with four or more articles indexed in ABI/Inform Global and Proquest Research Library-Business mentioning "military logistics" or "defence logistics" or "defense logistics" in the title, abstract, key words or text from 1952 to 2010

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irregular, surges. Furthermore, defence logisticians are often faced with a damaged physical and communications infrastructure, a shortage or lack of transport, loss of some functions of government, threat of physical violence in many forms, and the presence of many injured and traumatized individuals in the operational space (Kovács and Tatham, 2009). In short, whilst an error in a business logistics context can lead to a loss of profit or even to the demise of an organization, such a failure in the military domain can result in unnecessary death or injury to those involved.

And yet, arguably, there is a sea change taking place as the world of business becomes increasingly turbulent and challenges the relative stability of demand and supply patterns that underpin approaches such as "lean thinking" and "just-in-time" (Christopher and Holweg, 2011). The degree of uncertainty that characterizes many military operations (and, hence, their logistics needs) is beginning to be reflected in the business environment where researchers are increasingly arguing for more agile approaches characterized by supply networks that are better able to "sense and respond" in real time (Singh, 2009; Gattorna and Ellis, 2009; Christopher and Holweg, 2011). In doing so, these authors are clearly aligning the agile concept within Teece's dynamic capabilities model (Teece *et al.*, 1997; Teece, 2000, 2007) and, at the same time, are capturing the essence of many of the developments in today's military operations pioneered by the late Admiral Art Cebrowski during his time as the Director of the US Office for Force Transformation (Cebrowski and Garstka, 1998).

It must also be recognized that the majority of the activities in defence logistics are conducted not by uniformed personnel but by civilians who are employed in the public sector or as private sector sub-contractors. Certainly those logisticians operating in the "last mile" during a military operation are normally (but not exclusively) found in uniform, but behind the front line logistics support is provided through a myriad of complex contractual relationships that incorporate both public servants and multiple contractors ranging from major international companies to owner-operated vehicles (such as the "jingly" trucks in Afghanistan). Thus, the challenges facing military logistics organizations are similar to those in the private sector including the cost versus control dilemma inherent in outsourcing decisions; the need to develop resilient supply networks that can withstand the impact of significant uncertainty; and the effect of reducing product life cycles on inventory purchase decisions. It follows, therefore, that each community potentially has much to learn from the other and, again, this special issue can be seen as an important step in this process.

Changes in warfare are driving developments in defence logistics

The characteristics and practice of war have changed significantly over the past 150 years although, in practice, Boulding's "loss of strength gradient", which states that military power is diminished as the geographic distance from a home base or sanctuary increases (Boulding, 1962), has reflected reality over many decades. Furthermore, with the advent of the aeroplane as a weapon of war, one of the primary objectives of armed conflict became not just the destruction of an enemy's warriors, but also the opposing nation's ability to create, provide for, and sustain their war machine. Consequently, the enemy's industrial centres and cities became prime targets in the conduct of war. In parallel, the development of fast and effective tanks which, together with a concept of rapid attack or *blitzkrieg*, placed radically new demands on the logistics support mechanism. As a result, the determinants of victory were no longer pre-war planning

and the massing of formations, but rather speed, surprise and manoeuvrability, supported by a logistics pipeline and industrial base that was both responsive and capable of reliable, repeatable performance.

But meeting the resultant challenge of supplying highly mobile military units has had a lasting and massive impact in the field of business logistics. For example, during the Vietnam War the USA was heavily engaged in an asymmetric campaign. Even with modern heavy lift aircraft, trucking and shipping, the provision of logistics support through the use of break-bulk ships proved extremely difficult, not least because there were "insufficient deep water berths, inadequate cargo handling equipment and facilities, [. . .] [and] poor packaging of the cargo" (Olson and Scrogin, 1974). As a result, the US Navy worked closely with Malcom McLean, the "father of modern intermodal container movement", to develop the use of containerised transportation. The US Navy's insistence on a standard for the dimensions of a container was, in part, instrumental in ushering in the modern container shipping age and which, in turn, has made the growth of economic globalization possible (Levinson, 2006; Mangan *et al.*, 2012).

The Persian Gulf War (1990-1991), NATO operations in Bosnia (1994-1995), the War in Afghanistan (2001 to present), and the Iraq War (2003-2011) have all demonstrated the effectiveness of not only superior weapons, but also superior logistics capability in achieving decisive combat victory. Yet, despite advances in military technology and logistics support, recent conflicts have continued to demonstrate the challenges that remain in terms of asset visibility, coordination between multi-national forces, the management of time-phased force deployment plans, and command and control (Fontaine, 1997; Peltz *et al.*, 2005; GAO, 2011a). For example, in their report on military operations in Iraq in 2003, the UK House of Commons Public Accounts Committee (PAC, 2004) noted that:

> [. . .] [a]s a result of a combination of shortages of initial stockholdings and serious weaknesses in logistic systems, troops at the frontline did not receive sufficient supplies in a range of important equipments [. . .].

This view was reinforced by the Commanding Officer of one of the units involved in this conflict who observed that:

> [. . .] the delivery of logistic support to the front line during operations around Basra, Iraq, in early 2003 was woefully inadequate and has left a lasting mental scar on those soldiers in our care – a scar that will not readily heal (Blackman, 2005).

With the advent of missiles, space became a new arena to support and wage war. Satellite technology (and its near-relative, the unmanned aerial vehicle (UAV)) has enabled the precision delivery of munitions, unmanned reconnaissance of enemy territory, and communications between decision makers and their combatants who are thousands of miles apart. All of these innovations have not only enabled a revolution in military affairs (McKitrick *et al.*, 1995; Metz and Kievit, 1995), but have also generated new logistics challenges in achieving more effective and efficient delivery of goods and services to the battlefield.

These developments in the conduct of war notwithstanding, the role and purpose of logistics remains the same: to provide the military commander with options – to make plans or operational considerations feasible – and to provide support that is first and foremost effective, but also delivered as efficiently and economically as possible. As Kane (2001) stated so succinctly: "if politics is the art of the possible, logistics is the corresponding science."

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A research agenda for the future

The process of planning, aligning and synchronizing logistics plans with operational plans, forecasting, scheduling, inventory control, theatre distribution, logistics network design, surface replenishment on land and at sea, warehousing, and the establishment and coordination of relationships between actors in the supply system are all problems that persist today as they did 150 years ago. What has changed, however, is the technology, speed and economics that affect the problem formulations and the associated decisions, as well as the scientific methods that have been developed to wrestle with these enduring challenges. To the above list must also be added several new conditions and dynamics:

- the increased complexity and cost of new weapon systems;
- a broadening of the spectrum of military operations;
- an increase in joint operations (both between elements of a country's armed forces as well as within a coalition);
- the increasing role of military forces in humanitarian assistance and disaster response;
- maintenance and overhaul of both complex and aging weapon systems; and
- the adjustment of logistics to meet the emerging demands of today's increasingly information-based warfare.

Importantly, it does not take a great leap of imagination to frame this lengthy list of challenges in a business logistics context. In a way that would surely be understood by many commercial logistics managers, the trade-off between efficiency and effectiveness can be seen as a thread running through many of the areas of concern. However, the key points of differentiation remain the price of getting it wrong (unnecessary loss of life or injury) and the speed with which one may have to transition from an efficient (peacetime) to an effective (wartime) posture (and back again). With this in mind, we propose an agenda for future research consisting of six interdependent research clusters (Table II). The identification of these clusters being based on our analysis of a wide set of

Research cluster	Key issues
1. Sourcing	Performance-based logistics
	Third-party logistics
	Acquisition and contract management
2. Resiliency	Flexibility
	Robustness
	Risk management
3. Interoperability	Multinational cooperation
	Inter-service cooperation
4. Light footprint logistics	Use of local capacity
	Energy efficiency
	Remote maintenance
5. Managing the logistics supply network	Inventory management
	Stock positioning
6. Innovation and revolution in military affairs	Space operations
	Cyber warfare
	Unmanned systems

Table II.
A future research agenda for defence logistics

academic publications as well as on practitioner documents such as defence postures, defence innovation agendas and NATO's (2009) *Multiple Futures Project*.

Sourcing

In recent years there has been a surge in the outsourcing of logistical services, with examples as diverse as the construction of military compounds, the operation of UAVs, and the provision of complete security services. Within this research cluster, the use of performance-based logistics (PBL) contracts (under which the original equipment manufacturer (OEM) is paid to provide an outcome such as the operational availability of a particular platform or piece of equipment) remains an important area for research. Although much has been written championing the benefits of PBL, there are very little public data that can clearly demonstrate the relationship between cost and performance for specific contracts. Thus, whilst the idea that costs can be reduced in parallel with improved availability or enhancement of performance is self-evidently attractive, this thesis has yet to be borne out through conclusive empirical evidence in the literature.

A second key issue within this cluster is the use of third-party logistics (3PL), which is usually associated with the offering of multiple, bundled services, rather than just isolated transport or warehousing functions (Leahy *et al.*, 1995; Selviaridis and Spring, 2007). Research on 3PL in a defence context is needed to gain a deeper understanding of the behavioural complexities (such as civil-military organizational differences) that emerge through the interaction between the buyer and provider of logistics services. Furthermore, given that the stability and overall performance of 3PL arrangements are likely to be severely affected by the multiplicity of economic, technical and social bonds that develop during the relationship between the parties (Marasco, 2008), future research would benefit from investigations aimed at identifying and explaining the integrative processes that serve to bond partners and strengthen such relationships.

The area of acquisition and contract management contains a third key issue within the sourcing cluster. In a defence context, there is often a lack of a central authority that coordinates the activities of entities making up a supply network, leading to a situation whereby each is responsible for arranging and managing a contract with their partner that defines the collaboration in which they will engage. In addition, the production of increasingly complex and expensive weapon systems is characterized by the difficulty of precisely specifying the future product outcome and costs. Adding to the complexity of decision making is the presence of a variety of partners with different or competing interests (Kappert, 2011). Such new product developments can easily take 15-20 years to complete – a time period that further exacerbates the challenge as it often spans significant changes in technology, product requirements and political considerations, all of which have a concomitant impact on the logistics requirements. Moreover, in many countries, military personnel change jobs more frequently than their civilian counterparts and the resulting interface between the two cultures (and their associated non-profit and profit-related objectives) represents a significant management challenge, the successful resolution of which is key to the delivery of logistics support over the many decades after the platform or equipment has been successfully introduced into service.

Resilience

Military supply networks are exposed to a wide range of unexpected disruptions, and the resulting challenge is to make these networks resilient enough to continue

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operating in a high risk environment. The historic military solution has been the massing of large quantities of materiel to provide a buffer against uncertainty. However, there has been fierce criticism of the creation of these "iron mountains" and this leads to the need for further research that explores the tension between massing too much and becoming too lean, as well as understanding how resilience may be achieved at the lowest possible economic cost.

A second research issue within this cluster is that of flexibility. This involves the creation or promotion of capabilities for situations of unexpected disturbance (Volberda, 1996). As armed forces often operate in highly dynamic, complex and unpredictable environments, such flexibility is of the utmost importance in the creation of a resilient supply network. Future research should, therefore, focus on the development and application of dynamic capabilities within the armed forces that enable or promote the necessary flexibility. The associated management of risk is a third promising research issue. Following Jüttner *et al.* (2003), four critical aspects can be identified: assessing the sources of risk within the supply network, defining the supply network risk concept and adverse consequences, identifying risk drivers in the supply network strategy, and mitigating the risks for the supply network. To address these aspects an empirically grounded research programme is needed.

Interoperability

Contemporary military operations are often carried out by a multitude of nationalities, and the concept of interoperability reflects the ability of these different military organisations to conduct the joint (between services) and combined (between nations) operations (NATO, 2006) that are fundamental to mission success. While technological interoperability is unsurprisingly a major issue (Tolk, 2003), other aspects of interoperability such as culture, organisational structure, procedures and training can significantly influence the effectiveness of interactions between systems, units or forces in such operations (Clark and Moon, 2001). The military contribution to humanitarian logistics has added a further significant dimension to this challenge as it frequently sees organizations with fundamentally different philosophies (such as military and non-governmental organizations (NGOs)) having to work together for the common good of those affected by a disaster. This field has spawned an increasing number of contributions addressing the complexity and uniqueness of these types of operations (Van Wassenhove, 2006; Kovács and Spens, 2007; Rietjens and Bollen, 2008; Apte, 2009; Kovács and Tatham, 2010; Tatham and Pettit, 2010; Jahre and Jensen, 2010; Tatham and Houghton, 2011; Tatham and Spens, 2011; Kovács and Spens, 2011). Within this field, it is interesting to note that Tatham (2011) has argued that the commonality of the drivers of military and humanitarian logistics may act as a unifying force that would allow improved pre- and post-disaster cooperation. More generally, future research should focus on the development of the means to identify and understand the logistics needs of the various military (and humanitarian) organizations; the policies and procedures that enable system integration; and improved ways of achieving standardization.

Light footprint logistics

The fourth research cluster deals with the logistics "footprint", which can be broadly defined as the physical presence of the necessary equipment, supplies, personnel and infrastructure within a given operational area. Three key themes are identified within

this research cluster, and the first focuses on the use of indigenous capacity. As many military operations take place in austere locations, the use of locally sourced construction materials and labour, as well as food and water, can significantly reduce the burden on the logistics network. As a side effect, using such capacity can also help strengthen local economies and capacity building (Rietjens *et al.*, 2009; Kremers *et al.*, 2010). Future research could usefully focus on the specific tendering processes and criteria to select local providers, as well as on the absorptive capacity of the host nation (Kremers *et al.*, 2010).

The second issue within this cluster concerns energy efficiency. In its 2011 defence posture statement, the US Army states that "[t]o remain operationally relevant and viable, the Army must reduce its dependency on energy, increase energy efficiency, and implement renewable and alternate sources of energy" (US Army, 2011). Such a strategy not only contributes to cost savings, but also to a more sustainable force in terms of endurance, resilience and force protection. Some work is already being done in this area (Bartis and Van Bibber, 2011), but future research in this area could sensibly focus on improvements to the energy efficiency of weapon systems, the sustainment of deployed support bases, the incorporation of fuel costs throughout the entire life cycle of equipment, and the use of alternate sources of energy.

A third key research issue that can contribute to a lighter footprint is remote maintenance (i.e. addressing problems without being on-site) through the use of technology that enables geographically dispersed operations such as preventive maintenance or remote diagnostics in the event of system failure (Netherlands Ministry of Defence, 2008). Whilst many militaries have already begun to implement certain aspects of remote maintenance, future research should identify the military systems for which remote maintenance is feasible and, subsequently, address the design and implementation issues of such maintenance networks.

Managing the logistics supply network

Although an area that is well-trod in the business-related academic literature, research into more effective means of managing the defence logistics value (supply) network in general, and inventory in particular, is still required. Indeed, inventory management represents a significant expenditure within defence departments and it continues to be an area of concern for the US DoD as evidenced by the steady stream of Government Accountability Office (GAO) reports over the past decade (GAO, 1997, 2003, 2010, 2011a, b). However, future inventory research should move beyond the elaborate and often times arcane closed-form mathematical elaborations that have too long constituted much of the field. Rather, it is suggested that there is a need for research that develops the work of Hillestad (1982) who tied stock control directly to measures of combat capability; Girardini *et al.* (2004) who introduced a method for determining stock levels at forward (retail) locations during wartime; and Peltz *et al.* (2008) who offer a construct for designing wartime distribution networks that exploit the strengths of airlift and surface transportation modes to meet combatant command requirements at the lowest possible total cost. Furthermore, we propose more consideration of the defence logistical challenges by embracing methodologies ranging from empirical case studies, heuristic approaches that are supported by evidence of success, and simulation that provides not only solutions but "insights" to assist in the robust design of policies and logistical support structures.

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Innovation and the revolution in military affairs

As technological developments in areas such as social network analysis, space and nano technology continue with great speed, armed forces (and, thus, defence logisticians) are confronted with many new challenges. These include supplying more frequent, smaller payloads in space, the sustainment of distributed forces operating in small teams for long periods of time in remote locations, and the protection of critical information and communications technology (ICT) to reduce the vulnerability of sensor, weapon and command systems to cyber attacks in the acquisition and sustainment phases.

Unmanned systems provide a particularly important research area within this cluster. The use of UAVs that can fly autonomously or be piloted remotely to carry out intelligence, surveillance and reconnaissance, target acquisition, damage assessment, communication relay, and kinetic strike missions has increased markedly over recent years, and this trend is predicted to increase (Neuneck and Alwardt, 2008). In addition to the growth in the use of UAVs, unmanned underwater and surface systems are undergoing a similarly rapid phase of development, but the logistics requirements of these new systems are, as yet, relatively unknown territory. There are, as a result, many research opportunities – for example, the use of UAVs to act as tanker aircraft for more specialized UAVs (and an equivalent approach for land and sea-based unmanned systems) is certainly within the realms of technical feasibility. Exploring the implications of the sustainment of armed forces within networked operations, and how such environments may be exploited to improve effectiveness and/or efficiency, will be important to decision makers in the future.

The contribution of the special issue

Although we have outlined a daunting list of areas that would unquestionably benefit from further research, as special issue editors, we would like to pay tribute to the Journal's European Editors who proposed the original concept, and to the Editors-in-Chief for supporting us in the endeavour. We originally received eight submissions and, although these came from counties as far afield as Germany, Finland, Ireland, Norway, South Korea, The Netherlands and the USA, the relatively small number of manuscripts may, of itself, reflect the paucity of research in the field as a whole. Of these prospective contributions, three have been selected for the special issue.

In the first, Davids *et al.* conduct an exploratory investigation into the organization of armed forces logistics sourcing by the NATO-led International Security Assistance Force (ISAF) using a case study approach that included field research at operational locations inside Afghanistan. The authors find that Canada, The Netherlands, the UK, and the USA all use internal (or "make") approaches as well as external ("buy") mechanisms for acquiring each of the products and services of interest (facilities management, maintenance and logistics, and security). However, there are very significant differences in contracting strategies that range from "framework agreements" that are broad contracts with a logistics provider who then takes responsibility for provision of goods and services on request, to "procurement on demand on the international market" whereby each nation must comply with its own national contracting regulations to purchase goods and services from the international market. Whilst recognizing that, as ever, "one size does not fit all", the authors underline the key role that funding and accounting play as enablers and

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constraints on sourcing. The work of Davids *et al.* is important not only because it draws upon field data from an active war zone, but also because it endeavours to lay a foundation for future work in war-time sourcing through an exploratory case study methodology. As such, it points out many of the potential challenges to the improvements efficiency and effectiveness through international collaboration outlined above.

In the next paper, Glas *et al.* use a contingency approach to organizational theory supported by interview data to develop an instrument to assist military decision makers when considering whether to outsource a service or function to a private contractor through a PBL agreement. The authors note the similarities between commercial and military supply chains particularly during the "first mile", but also distinguish the two in relation to the "last mile" where the military often faces "damaged or poorly developed infrastructure, overstrained local authorities in host or foreign countries, and intended threats, ranging from theft to enemy attack". In addition, the authors emphasise the impact of the important differences in context, and in the motivations, goals and metrics of the parties involved. Glas *et al.* investigate the logistics tasks that may be outsourced as well as the extent to which private firms are able to influence the costs and performance of military logistics services and outcomes, with particular attention being paid to the demand characteristics for products and services targeted for outsourcing. Importantly, Glas *et al.* highlight that, for defence organizations, the role of logistics is not limited to ensuring "an effective and efficient flow of goods, services, and information, as in the private industry, but rather to ensure *mission capabilities when required*". Hence, they reinforce the contention that the role of logistics is to enable operations and to create options for the combatant commander.

In a relatively unusual contribution, Listou describes the use of a 3PL provider to support a Norwegian frigate conducting anti-piracy missions in support of Operation Atalanta off of the Horn of Africa. This work advances our knowledge in the domain of contracting, contractor management, outsourcing, 3PL, as well as logistics support of naval forces at sea and the design of "small footprint" logistics networks to support "agile" and "flexible" operations. Listou describes how the Norwegian Ministry of Defence collaborated and coordinated with the 3PL provider as well as the motivation for seeking out such a support arrangement in the first place. The conclusions from this work provide a number of helpful insights into how other nations might use 3PL support for operations similar to Atalanta, and helpfully raises questions as to how this model of support might need to be modified for short-term operations (of several months) as well as operations where naval combatants face peer or near-peer forces that are engaged in sea denial operations. Finally, the Editors-in-Chief have asked us to showcase Tatham's paper in the Defence Logistics Special Issue because of its relevance. Tatham's research is a recipient of the Emerald Dissertation of the Year Award for the logistics and SCM category. The manuscript assesses the relationship between the extent of the shared values within the UK's military supply network and the effectiveness of that network. The *IJPDLM* editorial team offers hearty congratulations to Dr Tatham for pushing the defence logistics envelope!

Conclusion

The editors of this special issue have all served in the armed forces of their respective countries (and, thus, have a particular interest in the field as a whole). Our work in developing the contributions has reinforced our view that, in multiple ways, the needs

of defence and business logistics are becoming increasingly similar and, indeed, intertwined – not least in a world of increasing uncertainty and turbulence. We would, therefore, strongly encourage readers of this Journal to contribute to the developing body of knowledge in defence logistics. Indeed, in a slightly mischievous way, we would venture to suggest that the relative absence of literature in this complex but absorbing field represents an "open goal" for researchers!

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