



MONOGRAPHIC SERIES
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THE NORWEGIAN DEFENCE UNIVERSITY COLLEGE
THE ROYAL NORWEGIAN NAVAL ACADEMY

NECESSE



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Militær logistikk i et
åpent systemperspektiv



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FORORD

Logistikkens rolle i krigføring er velkjent og vel anerkjent. Innen akademia regnes baron de Jomini som blant de første som omtalte og definerte logistikk som en av fem likeverdige faktorer innen krigskunsten;

D'après ces considérations il semble que l'art de la guerre se compose réellement de six parties bien distinctes. La 1re est la politique de la guerre ; La 2e est la stratégie, ou l'art de bien diriger les masses sur le théâtre de la guerre, soit pour l'invasion d'un pays, soit pour la défense du sien; La 3e est la grande tactique des batailles et des combats; La 4e est la logistique ou l'application pratique de l'art de mouvoir les armées; La 5e est l'art de l'ingénieur, l'attaque et la défense des places; La 6e est la tactique de détail. (Jomini, Précis de l'art de la guerre)

Her handler det om bevegelser på slagmarken. I et moderne perspektiv er dette utvidet til å omfatte både anskaffelser, transport og lagring, distribusjon og relasjons-håndtering i forsyningskjeder.

Utviklingen av det sivile og militære logistikkbegrepet og dets innhold skjer i tandem, der den militære tekningen har hatt stor innflytelse på kommersielle virksomheters strategier overfor markeder (både kunder, konkurrenter og leverandører), mens de kommersielle aktørenes vektlegging av internasjonale og globale forsyningskjeder på sin side har fått fotfeste i den militære forståelsen av logistikk. Bidragene i dette nummeret bygger alle på et premiss om at logistikk må ses i et åpent systemperspektiv; handlinger og effekter av handlinger påvirker, og påvirkes av, hva andre aktører i forsyningskjedene gjør. Forsvarets forsyningskjeder må derfor forstås som en kobling mellom en militær, intern del og en kommersiell, ekstern del. Tettere integrering mellom den militære og den kommersielle delen av forsyningskjedene har implikasjoner for hvordan Forsvaret organiserer sine egne logistikkaktiviteter, hvordan våre strategiske partnere utvikler og tilpasser sine tilbud og hvordan aktiviteter best kan gjennomføres i skjæringspunktet mellom den kommersielle og den militære logikken. Endringer i aktivitetsstrukturer i forsyningskjedene, for eksempel ved at aktiviteter flyttes fra Forsvaret over til en leverandør eller strategisk partner, eller at nye tjenester utvikles hos en ekstern partner, påvirker hva slags kompetanse Forsvaret bør beholde og videreutvikle internt. Logistikkpersonell må i større eller mindre grad omstille seg fra å være «doers» til å bli «managers of doers» for å kunne utnytte den kompetansen og kapasiteten som befinner seg utenfor Forsvarets hierarkiske struktur.

Bruk av strategiske partnere er i dag et viktig element i de militære forsyningskjedene. Forskerne Birkemo, Halvorsen og Graarud ved FFI utnyttet Trident Juncture 2018 til å studere vertsløstøtten under øvelsen for å forstå i hvilken grad Forsvarets logistikkssystem bygger opp under Forsvarets reaksjonsevne, utholdenhet og robusthet. De strategiske partnerne spiller en sentral rolle blant annet gjennom koordineringscellene ved NLOGS. Deres studie, som er inkludert i dette nummeret, fokuserte på åtte egenskaper ved logistikksystemet og hvorvidt de bidrar til bedre operative leveranser. De finner at ved å bruke ressursene til strategiske partnere sikret Forsvaret seg skalerbar tilgang på logistikkressurser – materiell, personell og tjenester – på områder som ikke er en del av Forsvarets kjerneoppgaver. De finner også at logistikksystemet legger til rette for kostnadseffektivitet. På den annen side viser de at det er et potensiale for ytterligere å forbedre ressursutnyttelsen, noe som kan gi kortere reaksjonstid og bedre logistisk utholdenhet. Som de fleste er klar over, blir logistikk sjelden testet til sine ytterste grenser i større øvelser. Rammeverket Birkemo et al. har utviklet er derfor et verdifulle bidrag til å gi kvalifiserte konklusjoner om logistikks bidrag til operativ evne, selv med empiri fra en fredstidsøvelse.

Et annet område der kommersielle aktører kan bidra til økt effektivitet er innen drift og vedlikehold av avanserte plattformer. Prestasjonsbaserte kontrakter (PBL) har blitt omtalt som et paradigmeskift innen anskaffelser og vedlikehold. PBL er et konsept eller tenkemåte som kommer fra forsvarsindustrien, i særlig grad fra amerikansk flyindustri. PBL ble blant annet presentert som en ny måte å organisere vedlikehold for F-35 på da flyet fortsatt ble omtalt som JSF. Selv om konseptet har eksistert i rundt 20 år er det lite akademisk forskning på hvordan konseptet faktisk anvendes. Som Andreas Glas peker på i sin artikkel, finnes noen kvantitative studier hvor man undersøker hvordan relevant personell oppfatter nytten av konseptet. I tillegg finnes kvalitative studier som beskriver kostnader, kontraktuelle forhold og definerte ytelsesindikatorer, men som i mindre grad identifiserer faktiske resultater av PBL-kontraktene. Ved å studere to cases fra USA og to fra Tyskland presenterer Glas en holistisk studie som gir svar på hvorfor fremforhandlede insentiver fører til bedre kostnadseffektivitet samt hvorfor PBL-kontraktsmekanismen ser ut til å være mindre populær nå enn det var på tidlig 2000-tall.

PBL-konseptet har sitt utspring i amerikansk flyindustri. Men også mindre nasjoner ser nytten av denne måten å organisere vedlikehold og forsyningskjeder på. De norske PBL-kontraktene er i hovedsak tilknyttet luftsystemer, som vedlikeholdskonseptet til F-35, F-100 motoren til F-16 og Hercules C130-J. I Sverige har man erfaringer med PBL for vedlikehold av deres treningsfly; Saab 105 (SK-60). Norge og Sverige skiller seg fra USA på endel områder. I hvilken grad identifiserte suksessfaktorer fra USA gjelder også for oss er tidligere ikke systematisk undersøkt. Dette rettes søkelyset på i Listou et al. Dette er en studie som bygger videre på to masteroppgaver skrevet ved Stabskolen samt studier gjort i Sverige. I tillegg til å identifisere faktorer som fremmer og hemmer implementering av PBL i vår hjemlige kontekst, gir studien også svar på hva ulike partnere, dvs merkantilt personell som fremforhandler avtalene, leverandør som tilbyr tjenestene, og mottakerne av PBL-tjenestene, vektlegger ved vurdering av PBL-regimet. Endelig diskuterer de hvorvidt potensialet for effektivisering som finnes ved å organisere forsyningskjedene på nye måter gjenspeiles i planmessige endringsprosesser internt i egen organisasjon.

Viktigheten av å tilpasse strukturer og rutiner til den enkelte organisasjons forutsetninger gjenspeiles i arbeidet til Ekström, Hilletoft & Skoglund. De poengterer at *“one size does not fit all”*. Statistiske modeller og tankesett for design av forsyningskjeder og valg av anskaffelsesstrategier tar ikke høyde for behovet for helhetlig perspektiv på de logistiske utfordringene ulike typer av organisasjoner har. De fleste modeller vi finner i lærebøker er basert på kommersielle virksomheter med profittmaksimering som mål. Militære forsyningskjeder skal selvsagt være mest mulig kostnadseffektive, men målet må alltid være å maksimere operativ evne, ikke finansiell avkastning. Dette er motivasjonen bak deres forskning. Denne artikkelen inngår i Thomas Ekströms doktorarbeid, og representerer dermed forskningsfronten innen utvikling og anvendelse av dynamiske porteføljemodeller (purchasing portfolio models) for militære anskaffelser.

Interoperabilitet er et viktig nøkkelord for å effektiv logistikk. Ikke bare i våre egne forsyningskjeder, men også i de alliansene og konstellasjonene vi skal operere i. Logistikk som åpent systemperspektiv oppfattes ulikt i ulike kulturer og tradisjoner. Vår «nordiske» tilnærming til samarbeid deles nok ikke fullt ut av alle våre allierte. Derfor skjer det mye viktig arbeid for å utvikle gode prinsipper som kan anvendes også i allierte konstellasjoner. Et slikt arbeid er Multinational Capability Development Campaign (MCDC), ledet av US Joint Staff. Norge har deltatt i flere initiativer knyttet til dette. Blant annet i MCDC syklus 2017-2018, der FHS, sammen med US Joint Staff, ledet et prosjekt med fokus på å skape «Global Integrated Logistics for Rapid Aggregation». I tillegg til Norge og USA deltok Finland og Sverige i dette prosjektet, mens Nederland, UK, Danmark og Japan hadde status som observatører. Et av resultatene av dette prosjektet var en studie av hvordan begrepet Operational Contractor Support, OCS, forstås i en alliert kontekst. Vi har valgt å ta med denne rapporten i dette nummeret, fordi det gir en god oversikt over hvordan OCS forstås i amerikanske doktriner, i NATO (der man bruker begrepet Contracting Support to Operations, CSO), og hvordan Norges tilnærming med våre strategiske partnere og koordineringscellene ved NLOGS ser ut til å ligge forkant av utviklingen.

Logistikk i et åpent perspektiv kan også ses på på andre måter. For eksempel som spredning av logistikk-kompetanse. Elvemo beskriver hvordan mentorering brukes som verktøy i Afghanistan for å øke kompetansen hos de som skal sørge for sikkerhet i eget land. Mentorering er viktig ikke bare for å øke kunnskap om militær taktikk og operasjoner, men også for å sikre gode logistikk- og støttesystemer. Som Elvemo peker på er forutsetningene for å etablere gode logistikkrutiner i Afghanistan vesentlig annerledes enn i Norge. Dette gir gode momenter til refleksjon over egen virksomhet og økt bevissthet om hvordan kultur, tradisjon og politikk influerer på logistisk effektivitet.

Bjelland & Stærkebye presenterer et annet perspektiv på spredning av logistikk-kompetanse, nemlig den kompetanselekkasjen vi har fra Forsvaret og ut til det sivile samfunnet. Gjennom sitt bachelorarbeid ved Sjøkrigsskolen gir de oss verdifull kunnskap om hvorfor så mange av våre logistikere velger å forlate Forsvaret til fordel for en sivil karriere. Nye konsepter, blant annet PBL, og tettere integrering med strategiske partnere stiller krav til ny og oppdatert logistikk-kompetanse hos

de som skal planlegge og lede logistikkaktivitetene. Det kan dermed synes som et paradoks at Forsvaret, i en tid der logistikk-konseptene er i hurtig utvikling, opplever at dyktige logistikkoffiserer tilsynelatende ikke oppfatter Forsvaret som en attraktiv arbeidsplass. Det er viktig at vi forstår årsakene til dette kompetansetapet for å kunne gjøre noe med det.

Et siste blikk på logistikk i et åpent systemperspektiv: I dette nummeret har vi fått med oss bidragsyttere også fra utenlandske militære universiteter. I tillegg til våre egne akademikere har vi bidragsyttere med fagfelleverderte artikler fra både Bundeswehr Universität (Tyskland) og Försvarshögskolan i Sverige. Det akademiske fagfeltet militær logistikk (Defence logistics) er fortsatt lite sammenlignet med andre militære fagfelt. Og ikke minst sammenlignet med de sivile, akademiske miljøene. Derfor er det viktig at vi bygger relasjoner mellom de militære universitetene og høyskolene som har akademisk, akkreditert utdanning innen militær logistikk, og mellom forskere som forsker på logistikk i en militær kontekst. På denne måten styrker vi relevansen til fagfeltet, blir bedre i stand til å tilby forskningsbasert logistikkundervisning, og kan bidra til forskningsbasert utvikling av Forsvarets logistikk.

Litt på siden av hovedtema men like fullt interessant for en marineoffiser har vi to fagfelleverderte artikler innenfor sjømakt og navigasjon. Tor Ivar Strømmen stiller i sin artikkel et meget ambisiøst spørsmål: Har teorier om sjømakt forklaringskraft for maritim strategi og krigføring. Diskusjonen vil opplyse enhver leser om et anstrengt, lærerikt og interessant forhold mellom teori og praksis. Noe som er viktig kunnskap med mye overføringsverdi, uavhengig av domene, tid og sted.

Etienne Gernez, Kjetil Nordby, Olav Eikenes og Odd Sveinung Hareide presenterer en analyse av Augmented Reality (AR) for navigering på bro. Her blir du opplyst på hvor forskningsfronten befinner seg, herunder hvilke type maritime applikasjoner som er tilpasset AR, hvordan de ble utviklet og evaluert og hva som gjenstår for å fungere tilfredsstillende for sikker bruk

Tore Listou

Fagredaktør Necessé, Militær logistikk i et åpent systemperspektiv

FORFATTERE



GUNN ALICE BIRKEMO

Gunn Alice Birkemo (Cand.scient, Phd) er utdannet ved NTNU og UiO og er ansatt som sjefsforsker ved FFI. Hun har siden 2008 drevet forskning innen strategiske forsvarsanalyser, samfunnssikkerhet, risikometodikk og logistikk. Birkemo leder et forskningsprosjekt som gjennomfører strategiske analyser av logistikk for forsvarssektoren.



ANNA BJELLAND

Anna Bjelland jobber som S4 ved Porsangerbataljonen ved Garnisonen i Porsanger. I perioden august 2017 til juni 2020 fullførte hun en bachelor i militær ledelse med fordypning i logistikk- og ressursstyring. Av tidligere militær erfaring har Anna gått Heimevernets befalsskole, jobbet i HV-16 og tjenestegjort som ass-S2 i artilleribataljonen,



JON OLAV EIKENES

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LASSE ELVEMO

Kommandørkaptein Lasse Elvemo er hovedlærer ved seksjon for militær logistikk ved Forsvarets Høgskole/ Sjøkrigsskolen. Han er uteksaminert fra Sjøkrigsskolen i 2005 og har siden hatt variert tjeneste innen fagfeltet militær logistikk. Høsten 2020 påbegynte han doktorgradsprogram ved Høgskolen i Molde med tittelen *Architecting resilience in military supply chain*.



ETIENNE GERNEZ

Etienne Gernez (PhD) is a senior researcher at AHO. He is a member of the Ocean Industries Concept Lab and has a background from maritime engineering



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Andreas H. Glas is Assistant Professor and Managing Director of the Defense Acquisition & Supply Management (DASM) research group at Bundeswehr University Munich. His research investigates the buyer-supplier interface and in particular performance-based contracts. He co-edited the Springer book *Performance-based Logistics* and his articles on the topic have appeared in journals including the *Journal of Enterprise Information Management*, *International Journal of Physical Distribution and Supply Management*, *Journal of Military Studies*, *Supply Chain Management (IPM)*, and *Journal of Public Procurement*. He can be contacted at andreas.glas@unibw.de



EMIL GRAARUD

Emil Graarud er utdannet siviløkonom og jobber som forsker innen forsvarøkonomi ved Forsvarets forskningsinstitutt. Hans forskning omfatter primært kostnadseffektivitet i sektoren og strategiske analyser innen logistikk. De siste årene har han hatt et fokus på vertslandsstøtte og alliert mottak.



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Nautical Advisor Research and Development in Norwegian Coastal Administration Pilot Service. Background as an officer and navigator in the Royal Norwegian Navy, MSc in Positioning and Navigation Technology and a PhD in Nautical Operations.



PER HILLETOFTH

Per Hilletoft is a Professor of Industrial Management at University of Gävle in Sweden and Visiting Professor at Jönköping University in Sweden. His research focuses on operations strategy, manufacturing location, supply chain design, new product development, and demand and supply integration. He has published articles in international journals including International Journal of Production Economics, Supply Chain Management: An International Journal, Production Planning and Control, Expert Systems with Applications, Industrial Management and Data Systems, Journal of Business and Industrial Marketing, Innovation: Organization and Management, Journal of Manufacturing Technology Management, and European Business Review. He has editorial assignments in several international journals.



GUNN ELISABETH HÅBJØRG

Brigader Håbjørg er sjef Forsvarets personell- og vernepliktsenter. Hun har variert tjenesteerfaring fra inn- og utland innen utdanning, operasjoner, virksomhetsstyring og ledelse. Kjernekompetansen er ledelse, økonomi, HR og virksomhetsstyring i et vidt perspektiv. Hun har blant annet vært Seksjonssjef budsjett, virksomhetsplan og regnskap FST samt stabsoffiser avdeling for personell og utvikling, FD, og økonomiansvarlig J8, ACT Heidelberg.

Håbjørg tok masterstudiet ved FHS i perioden 2013-2015, hvor hun skrev masteravhandlingen «Prestasjonsbasert logistikk i Forsvaret – faktorer som fremmer eller hemmer prestasjonsbasert logistikk i Forsvaret». I tillegg til FHS masterstudiet har Håbjørg studier innen sosialantropologi, sikkerhetspolitikk, konflikthåndtering og internasjonale relasjoner ved Universitetet i Tromsø samt logistikk og forsyning fra Høgskolen i Molde.



REMI JAKOBSEN

Kommandør(m) Remi Jakobsen er prosjektleder i Forsvarets Logistikkorganisasjon, og arbeider for tiden med utviklingen av en JLSG for JFC NF. Dette i rammen av nasjonalt logistikkoperasjonssenter (NLOGS). Han har vært sjef for seksjon for militær logistikk ved Sjøkrigsskolen og har en bred tjenestebakgrunn innen militær logistikk. Han har utdanning fra Sjøkrigsskolen og Stabsskolen, er Siviløkonom og har en master i Ledelse fra BI.



KJETIL NORDBY

Kjetil Nordby (PhD) is a professor at Oslo School of Architecture and Design. He is a research manager for Ocean Industries Concept Lab and he has led numerous design-driven research projects in the ocean industries.



TORE LISTOU

Tore Listou er førsteamanuensis logistikk ved Forsvarets høyskole. Han har en PhD i beredskapslogistikk fra Universitetet i Lund (Sverige), og har en bistilling som adjungerad lektor ved Försvarshögskolan i Sverige. Ved FHS er han ansvarlig for logistikkutdanning på masterstudiet i tillegg til å veilede masteroppgaver innen relevante emner. Hans forskning er knyttet til militære forsyningskjeder og beredskap, humanitær logistikk og FN-logistikk. Han har bred undervisningserfaring fra norske og nordiske høyskoler og universiteter



PER SKOGLUND

Lt.Col Per Skoglund (PhD) is Deputy Manager Joint Warfare Division and Section for Operational Functions, and Senior lecturer in Military Logistics at the Swedish Defence University. He also holds a part-time position as Associate Professor in logistics at the Norwegian Defence University College / Naval Academy. He received his PhD at Jönköping International Business School in 2012 with the thesis 'Sourcing decisions for military logistics in Peace Support Operations'. Before joining the Defence University he worked as Senior business adviser at FMV. He acts as the Chairman for Nordic Defence Security of Supply negotiations (part of NORDEFSCO), and is Swedish expert for Security of Supply in the European Defence Agency.



TOR IVAR STRØMMEN

Tor Ivar Strømmen er hovedlærer (orlogskaptein) i sjømakt og maritime operasjoner ved FHS/Sjøkrigsskolen med spesialkunnskap innen sjøkrigshistorie, militærteori, strategi, doktriner og maritime operasjoner. Han har ingeniør- og historieutdanning fra NTNU, ettårig officerskurs ved FHS/Sjøkrigsskolen, langkurs i maritime operasjoner med spesialisering i K2IS (LMOPS/CIS), Maritime Warfare Course i Royal Navy og en master i historie ved UiB med spesialområde strategisk ledelse. Han er for tiden PhD-stipendiat ved UiB finansiert av FHS og skal forske på strategi og maritim operasjonskunst. Han har omfattende operativ sjøtjeneste på MTB-er og fregatt (Oslo- og Nansen-klassen), samt tjeneste som Staff Communications Officer i SNMG1 (NATOs stående eskortefartøygruppe). Strømmen har også tjenestegjort som operasjonsoffiser for Sjøforsvaret, og har annen stabstjeneste innen fagområdene operativ planlegging, operativ evaluering og kommando/kontroll. Han var en av hovedforfatterne i STP-41 *Sjøforsvarets stabs håndbok og Forsvarets doktrine for maritime operasjoner* (FDMO).



MARTE S. STÆRKEBYE

Marthe S. Stærkebye jobber som ass-A4 ved Maritim helikopterving på Bardufoss. I perioden august 2017 til juni 2020 fullførte hun en bachelor i militær ledelse med fordypning i logistikk- og ressursstyring. Av tidligere militær erfaring har Marthe gått på Luftforsvarets utskrevne befalskurs, før hun jobbet som både rekruttskoleinstruktør og troppssjef ved KNM Harald Haarfagre.



TORGEIR EKERHOLT SÆVERAAS

Torgeir E. Sæveraas er utdannet historiker med PhD om Organisation Todt og utbyggingen av «Festung Norwegen» fra NTNU (2017). Han har tidligere jobbet som forsker, lærer og redaktør ved IFS, Luftkrigsskolen og FHS/Stabsskolen. For tiden arbeider han fulltid som frilans forfatter, og hans neste bok *Krigens skjebnesone. Wehrmacht i Norge* har tentativt utgivelsestidspunkt vinteren 2021.



PER ERIK SØRGAARD

Major Per Erik Sørgaard er prosessleder ved Norwegian Logistics Operations Center F-35/132 Luftving. han har tidligere vært A-4 seksj/Lufting stab 132 og Prosjektoffiser log ved LOG/P7661 NAWSARH/Flo Logkap. I perioden 2016-2017 var han student på masterstudiet ved FHS, og skrev masteroppgaven «Nytt luftmateriell i Forsvaret – et paradigmeskifte?».

1.

FAGARTIKLER

Hvorfor slutter logistikkutdannet personell i Forsvaret?

Anna Bjelland og Marthe S. Stærkebye

Våren 2020 leverte vi en avsluttende bacheloroppgave innen utdanningen *bachelor i militær ledelse med fordypning i logistikk- og ressursstyring* ved Sjøkrigsskolen. Oppgaven hadde følgende problemstilling: hvorfor slutter logistikkutdannet personell i Forsvaret? Frem til arbeidet med denne oppgaven startet, hadde de antatte årsakene til fratredelse blant logistikkutdannet personell sprunget ut fra myter. Ønsket vårt var derfor å tilføre et datagrunnlag basert på faktisk dialog med fratrådt personell, et datagrunnlag som om hensiktsmessig kunne benyttes i videreutvikling av Forsvarets personellpolitikk.

Denne artikkelen tar utgangspunkt i funnene som blir drøftet i bacheloroppgaven, men presenterer følgelig et litt mer subjektivt syn på problematikken enn hva oppgaven gjør. Du kan lese oppgaven i sin helhet i Bibsys Brage, eller ved å ta forbindelse med én av forfatterne.

«DU ER VÅR VIKTIGSTE RESSURS.»

Personellet, og dets kompetanse, omtales ofte som Forsvarets viktigste ressurs. Til tross for dette har Forsvaret lenge «satset på at færre skulle gjøre mer», og blitt for tynne på personellsiden (Bentzrød, 2019). Dette har redusert Forsvarets kompetansekapital¹ og gjort etaten sårbar for kompetansetap gjennom fratredelser. I en tid hvor Forsvaret skal styrkes er det derfor viktig rekruttere kompetanse, men også å redusere frafall fra personellstrukturen ved å «bruke alle virkemidler for å beholde relevant personell» (FMR, 2019, s. 68). For å kunne beholde relevant personell må, derimot, de faktiske årsakene til fratredelse identifiseres.

Fratredelse blant logistikkutdannet personell har lenge vært et diskusjonsemne i Forsvaret. Mytene er mange, men det faktiske datagrunnlaget er mangelfullt. Manglene i datagrunnlaget utgjorde i stor grad motivasjonen for bacheloroppgaven vi skrev. Gjennom faktisk dialog med fratrådt personell ble mytene avstemt og følgende problemstilling ble besvart:

Hvorfor slutter logistikkutdannet personell i Forsvaret?

Oppsummert er det flere årsaker til fratredelse blant logistikere, hvor mistillit til beordringssystemet, manglende opplevelse av anerkjennelse, og fraværet av en helhetlig kompetansestyring skiller seg vesentlig ut. Hovedfunnene har én fellesnevner: det mangler dialog mellom logistikkoffiseren og Forsvarets personellforvaltere. Mangelen på dialog gjør at mange av logistikere baserer sin oppfattelse av personellforvaltningen på antagelser og etablerte sannheter, fremfor faktiske mangler ved personellforvaltningen. Antagelsene er likevel berettigede da de er subjektive opplevelser som Forsvaret må ta stilling til i forvaltningen av personellet. Hvis ikke, vil personellet og deres kompetanse forsvinne fra Forsvaret, de aller fleste for godt.

FRA MYTER TIL DATAGRUNNLAG

Arbeidet med oppgaven startet høst 2019 og strakk seg til våren 2020. Figuren under viser i grove trekk hvordan arbeidsprosessen foregikk.



Figur 1: Arbeidsprosessen

¹ Kompetansekapital: Kompetanse som er tilgjengelig, anvendbar og verdifull utgjør organisasjonens kompetansekapital (Lai, 2013, s. 60).

Tidlig i arbeidet ble vi presentert for myter rundt hvorfor logistikere slutter i Forsvaret. Dette gjorde at problemstillingen ble utviklet med utgangspunkt i en deduktiv tilnærming, og arbeidet startet med noe forutinntatthet. Vi søkte altså i stor grad etter å bekrefte eller avkrefte antagelser (Jacobsen, 2005, s. 23). Denne tilnærmingen kan ha begrenset, og dernest også svekket datainnsamlingen.

Populasjonen bestod av fratrådt personell fra graduasjonsskull 2005 til 2016, totalt 57 personer. Avgrensningen ble gjort da kull før 2005 var vanskelig å spore opp i SAP og kull etter 2016 hadde av våren 2020 ikke hatt mulighet til å slutte i Forsvaret. Vi valgte å behandle populasjonen som en helhet, med mindre signifikante trender innenfor en gitt gren eller kull skulle vise seg. Vi forutsatte at alle de 57 fratredelsene var frivillige.

I første omgang benyttet vi en elektronisk spørreundersøkelse for å samle inn kvantitativ primærdata². Undersøkelsen ble distribuert via mail, tekstmelding og en intern Facebook-gruppe for SKSK-alumner. Innsamlingsmetoden viste seg å være både tid- og kostnadseffektiv, og svarprosenten var høy. Med unntak av ett åpent spørsmål var svaralternativene kategoriske. Forhåndsbestemte svaralternativer forenklet kategoriseringen av respondentene, men kan samtidig ha svekket datainnsamlingen da alternativene begrenset respondentens mulighet til å utdype (Jacobsen, 2005, s. 239). Enkelte spørsmål hadde svaralternativet «annet», men det var ikke mulig å stille oppfølgingsspørsmål dersom respondenten valgte dette alternativet. Muligheten for å utdype svaret ville, ifølge NSD³, utfordret respondentens anonymitet.

Resultatene fra den elektroniske spørreundersøkelsen inneholdt flere signifikante trender, hvorav mye syntes å peke mot enten en bekreftelse eller avkrefte av antagelsene våre. I den hensikt å gi populasjonen mulighet til å uttale seg mer åpent, og utover svaralternativene i undersøkelsen. Tilnærmingen vår ble mer og mer induktiv. Den kvalitative primærdataen ble samlet inn gjennom seks intervjuer fort over Skype. Ettersom utvalget skulle representere populasjonen i størst mulig grad, ble følgende kriterier lagt til grunn:

1. Samtlige forsvarsgrener skal være representert.
2. Begge kjønn skal være representert.
3. Flere kull skal være representert.
4. Ståtiden skal variere i utvalget.

En pre-strukturert intervjuguide ble sendt ut i forkant av intervjuet, dog kun med åpne spørsmål da datainnsamlingen skulle være så åpen som mulig. For å redusere risikoen for feiltolkning ble intervjuene diktret, og transkribert senest én uke etter gjennomføring. Da transkriberingen endelig var ferdig hadde vi brukt fire uker på både kvantitativ og kvalitativ datainnsamling. Resultatet var et stort, nytt og veldig unikt datagrunnlag.

² Primærdata: Dataen er samlet inn av forskeren selv for første gang (Jacobsen, 2005, s. 124).

³ NSD: Nasjonalt senter for forskningsdata. Hvis forskningen skal behandle personopplysninger må NSD først godkjenne prosjektet. Dette er for å sikre at prosjektet er i samsvar med personvernlovgivningen.

JAKTEN PÅ DEN OBJEKTIVE FREMSTILLINGEN

Utfordringen som nå lå foran oss var å analysere og bearbeide datagrunnlaget så objektivt som mulig. Vi kunne ikke utelukke at både respondentene og vi kunne fremstå med bias. Ettersom hensikten med oppgaven ikke var å tale logistikernes sak, men lage en objektiv fremstilling av tematikken, måtte bias motvirkes. Vi tok derfor forbindelse med informanter fra ulike forsvarsgrener. Informantene hadde alle god kjennskap til HR-området og personellforvaltningen i Forsvaret, og kunne med sin kunnskap belyse tematikken fra «den andre siden». Det er ikke gitt at andre informanter hadde gitt likelydende svar som de vi brukte, men innspillene bidro uansett til å balanse fremstillingen av tematikken.

Tross fokuset på å motvirke bias med informanter, kom vi ikke foruten at datagrunnlaget presenterer et ensidig perspektiv. Fraværet av et datagrunnlag fra de som har valgt å bli i Forsvaret forsterker eventuelle bias, samtidig som den eksterne gyldigheten til studien blir utfordret. Da vi bearbeidet dataen var det derfor essensielt at vi ikke generaliserte funnene til logistikkpersonell forøvrig, kun til fratrådt logistikkpersonell som hadde bidratt i datainnsamlingen. I tillegg er det viktig å være klar over at andelen logistikkutdannet personell som har valgt å bli værende i Forsvaret er større enn andelen som har fratrådt. Å finne den objektive fremstillingen av tematikken ble derfor utfordrende – kanskje aller mest fordi respondentene gjennomgående presenterte et så kritisk syn på personellforvaltningen.

DEN TEORETISKE GRUNNMUREN

Som hovedteori og teoretisk rammeverk for oppgaven brukte vi *Strategisk kompetansestyring* (2013) av Linda Lai. Lai skildrer teori som omhandler kompetanse som ressurs, hvordan kompetansen burde mobiliseres for å oppnå best mulig resultat og effekt, hvordan man skal bedrive strategisk kompetanseledelse, og mål på jobbprestasjon. Det fremkommer av *Direktiv for HR-området* at Forsvaret skal drive med strategisk kompetansestyring, samt at HR-strategien skal sikre rett kompetanse på rett sted, til rett tid og i rett mengde (Bruun-Hanssen, 2014). Ettersom Lai anses som ledende innenfor dette fagfeltet, ble det naturlig å ta utgangspunkt i hennes verk da vi skulle drøfte dagens kompetansestyring i Forsvaret.

Lai betrakter strategisk kompetanseledelse som en syklisk prosess. Syklusen innebærer planlegging, gjennomføring og evaluering av en rekke tiltak, hvor tiltakene skal sikre at kompetansen til medarbeiderne i organisasjonen brukes til å nå fastsatte mål (Lai, 2013, s. 14). I denne syklusen er det viktig å være klar over at organisasjonen aldri vil eie kompetanse, på lik linje med at organisasjonen aldri vil eie sine medarbeidere. Den kompetansen som medarbeiderne besitter må stimuleres, reinvesteres, utvikles og mobiliseres – hvis ikke vil den totale kompetansekapitalen til organisasjonen falle i verdi (Lai, 2013, s. 61).

Kompetansen vil altså øke i verdi ved løpende bruk, samtidig som at den er lett å overføre både mellom oppgaver, individer og organisasjoner, uten at kompetansekapitalen minsker (Lai, 2013, s. 62). Det vil snarere oppstå en form for kompetansedobling. Tappt kompetansekapital vil først forekomme dersom med-

arbeidere forsvinner fra organisasjonen, eller hvis kompetansemobiliseringen⁴ er lav. Ettersom kompetansemobilisering er vanskelig å måle, er medarbeiderens oppfatning en viktig indikator å bruke for å kunne si noe om hvorvidt kompetansemobiliseringen er høy eller lav (Lai, 2013, s. 154). En felles forståelse for hvordan, og hvorfor, kompetanse forvaltes som den gjør, vil bidra til en økt gjensidig forståelse mellom medarbeider og forvalter. Gjennom gjensidig forståelse vil begge parter kunne bidra til en bedre utnyttelse av kompetanse som ressurs, og potensielt kunne forhindre unødvendig frafall.

DE «HARDE» FAKTAENE

Det kvantitative datagrunnlaget ble innhentet via en elektronisk spørreundersøkelse, og bestod av svar fra alle 57 respondentene. Datagrunnlaget tegnet således et godt bilde på populasjonen. De spørsmålene som resulterte i signifikante funn, og således dannet grunnlaget for videre datainnsamlingen gjennom dybdeintervjuer, er presentert under med utfyllende kommentarer.

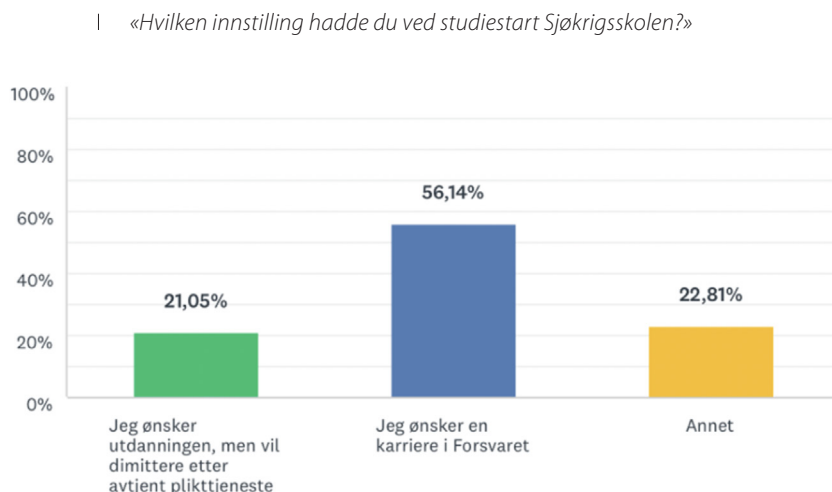


Diagram 1: Innstilling ved studiestart på Sjøkrigsskolen

Hensikten med dette spørsmålet var å bekrefte eller avkrefte den etablerte sannheten om at personell på logistikk- og ressursstyringslinjen kun ønsker utdanningen, og vil fratre så fort plikttiden er avtjent. Resultatet viser at dette er en sannhet som gjelder for 21 % av populasjonen, dvs. 12 personer. På en annen side har vi

⁴ *Kompetansemobilisering: En aktivitet som binder kompetanse som ressurs til oppnådd resultat og effekt. Mobiliseringen er hovedsakelig et lederansvar ettersom viktige drivere for aktiviteten ligger utenfor medarbeidernes kontroll (Lai, 2013, s. 156 & 180).*

ikke har tall på hvorvidt disse 12 endte opp med å tjenestegjøre mer enn tre pliktår før de valgte å slutte. Mye tyder altså på at innstilling kan være en bidragsyter til fratredelse, men ikke nødvendigvis årsaken bak alle fratredelsene. Det er også verdt å nevne at mange av logistikere som har valgt å bli i Forsvaret potensielt hadde samme innstilling som 12 av disse respondentene.

I «Hva påvirket din avgjørelse om å slutte i Forsvaret? (Mulig å krysse av flere)»

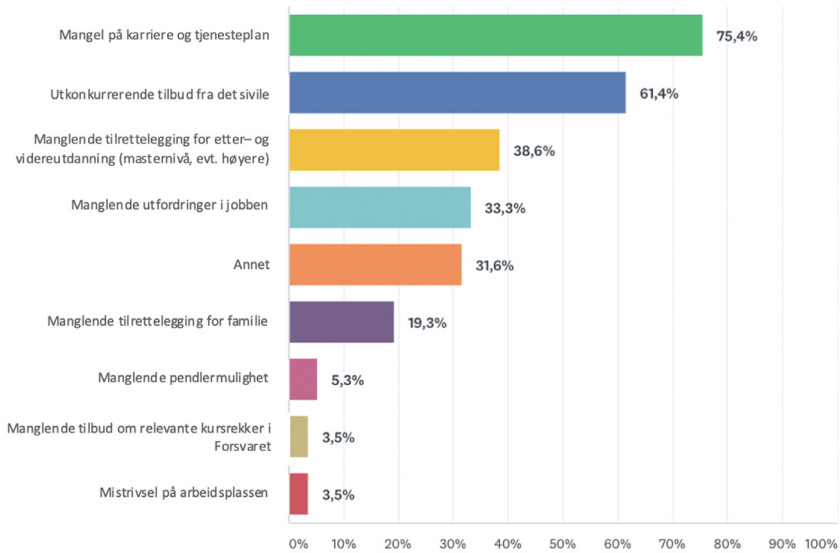


Diagram 2: Årsaker til fratredelse fra Forsvaret.

Siden de aller fleste respondentene oppgav flere enn én årsak, er det vanskelig å si noe om hvor tungt eksempelvis mangel på karriere og tjenesteplan veide i den enkeltes avgjørelse om å fratru. Likevel er enkelte av årsakene såpass gjentakende at funnene må regnes som vesentlig, og de gir med det gode indikasjoner på hva som i størst grad bidrar til fratredelse blant logistikere. Hovedsakelig er det to årsaker som fremstår som viktigere enn de andre: «Mangel på karriere- og tjenesteplan», og «Utkonkurrerende tilbud fra det sivile».

Hvis du svarte «Utkonkurrerende tilbud fra det sivile», på hvilke områder var det sivile tilbudet utkonkurrerende? (Mulig å krysse av flere)

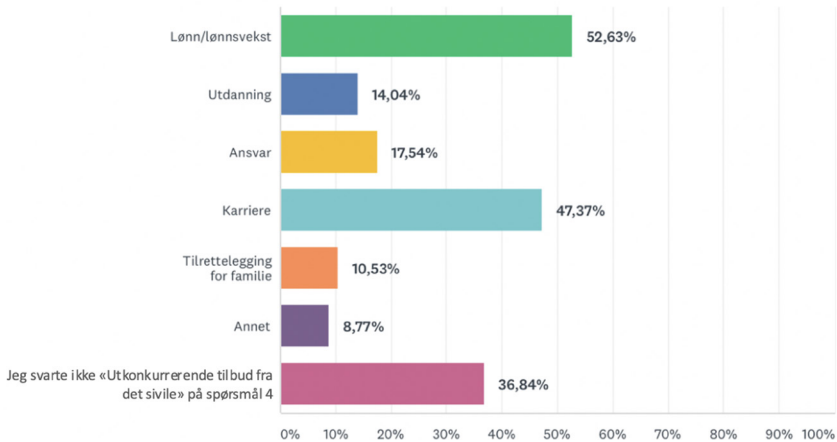


Diagram 3: Området hvor sivile tilbud var utkonkurrerende.

Vi antok på forhånd at «Utkonkurrerende tilbud fra det sivile» kom til å være en fremtredende årsak. Hensikten med dette oppfølgingsspørsmålet var derfor å bekrefte eller avkrefte den etablerte sannheten om at logistikkutdannet personell fratrer fordi lønnen er så mye bedre i det sivile. Siden utkonkurrerende tilbud fra det sivile viste seg å være en årsak til fratredelse for 35 av 57 respondenter, var vi takknemlige for at vi gav respondentene muligheten til å utdype litt mer gjennom dette oppfølgingsspørsmålet. Flere faktorer viste seg som fremtredende, noe som bekrefter at bedre lønn alene ikke nødvendigvis er årsak nok til å velge å fratre fra Forsvaret.

| Hva hadde gjort deg villig til å fortsette din karriere i Forsvaret?

Dette var det siste spørsmålet på undersøkelsen. Spørsmålet var et frivillig fri-tekstspørsmål uten svaralternativer som totalt 31 respondenter valgte å besvare. Hensikten med spørsmålet var å avdekke et bredt spekter av årsaker, og gi respondentene muligheten til å utdype mer rundt sine individuelle fratredelsesårsaker. Svarene var i stor grad gjentagende, og vi valgte derfor å samle de i følgende kategorier:

- Mistillit til beordringssystemets forvaltning og vurderingsgrunnlag
- Manglende anerkjennelse for kompetanse, i form av lønnsvekst og gradsavansement
- Lav kompetansemobilisering
- Utilstrekkelig personellforvaltning med tanke på forutsigbarhet

Av kategoriene var det blant annet 50 % av respondentene som trakk frem beordringssystemet som forbedringspunkt, der mange eksemplifiserte mistilliten med egne negative opplevelser knyttet til beordringssystemet. Med et stort kvantitativt datagrunnlag gikk vi inn i de seks dybdeintervjuene med en innstilling om å grave dypere i tematikken. Samtalene med disse seks beriket datagrunnlaget ytterligere, og vi følte nå at det forelå et tilstrekkelig datagrunnlag til å diskutere hvorfor logistikkutdannede personell slutter i Forsvaret.

HVORFOR? DE MANGLER TILLIT.

Som nevnt ovenfor skisser mange av respondentene en opplevelse av et beordringssystem som avviker fra hvordan det er tiltenkt å fungere. Til tross for at beordring skal skje basert på villighet, opplever flere av respondentene å få sin villighet inndratt, eller overstyrt, uten videre begrunnelse. Mye av mistilliten blant logistikerne har grobunn i at få opplever å kvalifisere seg til evalueringsbunken for lederstillinger. Mange tror begrunnelsen er bransjetilhørighet, dvs. at (F) i personellprofilen utelater logistikkoffiseren fra konkurranse i beordringsprosessen⁵. Ett intervjuobjekt beskrev forholdet sitt til beordringssystemet slik:

Jeg skyr det som pesten. (...) Jeg skulle gjerne sett at alt kunne vært søknadsbasert frem til det viste seg at Forsvaret ikke klarte seg. (...) Jeg har ingen tillit til at beordringssystemet klarer å ta stilling til våre ønsker og behov, eller at det er en rettferdig konkurransearena (Intervjuobjekt 4, 2020).

Det er ikke nødvendigvis riktig at bransje hemmer deltakelse i evalueringen. Bransjetilhørighet kan, derimot, gi konkurransefortrinn dersom kandidatene stiller likt (Skinnarland, 2017, s. 4). Således kan mye tyde på at opplevelsen av et ekskluderende beordringssystem ser ut til å springe ut fra etablerte sannheter, fremfor faktiske mangler ved beordringssystemet. Det gjør, derimot, ikke opplevelsene mindre relevante. Kanskje vil en bedre dialog rundt hvordan beordringssystemet forvaltes, og hvordan den enkelte har mulighet til å påvirke prosessen, redusere noe av mistilliten som foreligger.

HVORFOR? DE MANGLER ANERKJENNELSE.

Flere av respondentene uttaler at de opplever liten grad av anerkjennelse knyttet til jobbprestasjon, innsats og kompetanse. «... uavhengig av min innsats, hvor mange skussmål eller ekstra timer jeg legger inn i arbeidet, vil jeg få opprykk på akkurat samme tidspunkt som den dårligste i kullet mitt» (Intervjuobjekt 6, 2020). Sitatet er hentet fra et av dybdeintervjuene hvor vedkommende beskriver godt frustrasjonen som er knyttet til anerkjennelse. Logistikerne omtales ofte av HR-arbeidere som ambisiøse

⁵ Forsvarets personell er kategorisert inn i tre bransjer: operativ (O), forvaltning (F) og teknisk (T). Fullført utdanning ved Sjøkrigsskolens logistikk- og ressursstyringslinje gir tilhørighet til forvaltningsbransjen (Skinnarland, 2017).

og målrettede personer (Åsen, 2020). Disse ambisjonene og målbevisstheten fører til behov for progresjon, kompetansemobilisering og anerkjennelse. Disse behovene stiller høye krav til arbeidsgiver, men samtidig vil manglende imøtekommelse gjøre organisasjonen sårbar for fratredelse.

I det sivile er lønn/lønnsøkning og forfremmelse anerkjente indirekte mål for jobbprestasjon. I Forsvaret er grad lønnsdriver, og normalavancement avgjørende for gradsutvikling. Dette resulterer i at det er få gjenstående indirekte mål på jobbprestasjon. Manglende anerkjennelse ser ut til å lede til en søken for anerkjennelse og videreutvikling andre steder. Det synes altså vanskelig for Forsvaret å gjøre seg konkurransedyktige gjennom utmåling for lønn og avancement. Når det er sagt kan det diskuteres hvorvidt Forsvaret faktisk skal tilstrebe å imøtekomme alle behovene som skisseres av respondentene, da imøtekommelsen ikke nødvendigvis er formålstjenlig for Forsvaret. Forsvarets behov skal og må være styrende for organisasjonen, men i styringen burde også medarbeidernes behov tas høyde for. Kanskje har Forsvaret noe å lære av det sivile hva angår eksempelvis anerkjennelse av den enkelte medarbeider, så fremt det ikke koster mer enn det gir⁶.

HVORFOR? DE MANGLER EN PLAN.

Det fremkommer av *HR-Strategien* (2015) at Forsvaret skal sikre rett kompetanse, til rett tid og i rett mengde. Bruken og utviklingen av denne kompetansen skal skje i tråd med blant annet karriere- og tjenesteplaner (KT). KT er ment som er verktøy for å styre kompetansen langsiktig, noe som skaper forutsigbarhet for arbeidsgiver og arbeidstaker. Respondentene stiller seg dog kritiske til hvorvidt KT skal være så forutsigbar at den går på bekostning av valgmuligheter:

Planen var jo veldig grov. Den inneholdt vel bare at du kunne gå fra ass A4, til A4 og videre til A4 i Luftforsvarsstaben. KT hadde på den måten ikke med alt av muligheter, samt at den var begrenset til tjeneste kun innenfor Luftforsvaret (Intervjuobjekt 4, 2020).

KT for logistikeren i Luftforsvaret er ikke fult så snever, men intervjuobjektet belyser et viktig poeng. Verktøyet oppleves som begrensende, mye fordi det blant annet ikke skisseres muligheter for stillinger utenfor egen driftsenhet i Forsvaret (DIF). Flere respondenter finner dette problematisk, og tror dette kan skyldes en frykt for at personellet ikke returer etter å ha vært på «utveksling» i en annen DIF. Et annet intervjuobjekt påpeker hvordan nettopp KT potensielt kan løse denne problemstillingen: «Kanskje kunne man hatt en økt grad av totrinnsbeordring, at

⁶ *Bacheloroppgaven Personellforvaltning – en balansekunst* (Bjelland & Stærkebye, 2020), som denne artikkelen tar utgangspunkt i, ble ferdigstilt før Svendsen-utvalget leverte sin rapport i juni 2020. Svendsen-utvalget skulle komme med innspill til hva Forsvaret kunne lære av det sivile for å bedre rekruttere, beholde, utvikle og avvikle kompetanse. Av rapporten fremkommer det blant annet at det er avgjørende å anerkjenne og dyrke frem de beste, samt at «... det er også vanskelig å se hvordan et slikt system (gradssystem, red.anm.) gir tilstrekkelig rom for å meritte og dyrke frem det å være faglig god» (Svendsen-utvalget, 2020).

du tar to år i denne jobben og får to år automatisk i denne jobben» (Intervjuobjekt 5, 2020). En slik løsning vil både gi forutsigbarhet for arbeidsgiver og arbeidstaker, samt at det tilrettelegges for kompetanseoverføring på tvers av DIFene.

At en logistiker bytter DIF, enten midlertidig eller permanent, vil ikke medføre en verdilekkasje for Forsvaret som organisasjon. Verdilekkasjen oppstår først når logistikeren fratrer. Som nevnt listet 43 av 57 respondenter «mangel på karriere og tjenesteplan» som minst én av årsakene til fratredelse, ref. diagram 2. Det synes altså av datagrunnlaget at Forsvaret kan være tjent med å evaluere bruken av dagens KT, da planen ikke nødvendigvis samsvarer med medarbeidernes behov eller ønsker.

FELLESNEVNEREN

Manglende tillit, anerkjennelse og plan synes å alle ha én fellesnevner: fraværet av dialog. Manglende dialog gjør at logistikere har liten innsikt og forståelse for hvordan personellforvaltningen praktiseres. Dette synes å føre til at opplevelsene deres springer ut fra etablerte sannheter, fremfor faktiske mangler ved forvaltningen. Opplevelsene blir, derimot, ikke mindre relevante av den grunn. Det er en grunn til at uttrykket «du er din egen personelloffiser» har blitt et hyppig brukt uttrykk blant forsvarsansatte, noe som synliggjør at det kanskje er på tide å øke dialogen mellom Forsvarets viktigste ressurs og dens forvalter.

En av intervjuobjektene påpeker viktigheten som ligger i forvaltningsansvaret, og hvordan man er «... *prisgitt hvem man har som linjeleder, og hans eller hennes kompetanse, og vilje til å hjelpe deg*» (Intervjuobjekt 5, 2020). Det er ikke nødvendigvis riktig å «rette pekefingeren» på HR-medarbeiderne eller linjelederne, men heller rette søkelyset på viktigheten av personellforvaltning som en helhet. Bedret dialog og kunnskap rundt eksempelvis beordringssystemet og karriere- og tjenesteplanene vil potensielt gi medarbeiderne økt gjensidig forståelse og tillit til systemet som forvalter de, uavhengig av linjeleder.

Det var nettopp denne fellesnevneren, fraværet av dialog, som var motivasjonen vår da vi skrev bacheloroppgaven om hvorfor logistikkutdannet personell slutter. Frem til nå var det ytterst få som faktisk hadde spurt logistikere om hvorfor de valgte å slutte. Ingen hadde i hvert fall spurt alle. Dialogen har ført til en helt ny og unik forståelse rundt valgene om å fratre, en forståelse man ikke hadde fått utelukkende gjennom dataanalyser av SAP-register. På lik linje kan heller ikke personellet forvaltes utelukkende gjennom en dataskjerm.

VEIEN VIDERE

Arbeidet med å avdekke hva Forsvaret kan gjøre for å redusere frafall av relevant personell er på ingen måte ferdig, det har så vidt begynt. I skrivende stund pågår det en debatt som omhandler funnene gjort av Svendsen-utvalget, i tillegg til at rapporten skal på høring (Forsvarsdepartementet, 2020). I arbeidet vårt med oppgaven for rundt et halvt år siden oppdaget også vi flere interessante vinklinger på tematikken som vi anså som interessante for videre forskning. Vi vil velge å trekke frem én av disse – konkurransen om kompetansen.

Tidligere forsvarsminister, admiral Haakon Bruun-Hanssen, uttalte under et foredrag for Sjømilitære Samfund i februar 2020 at «Det er konkurranse om kom-

petansen, og vi har tenkt å være med i den». Re-rekruttering tilbake til Forsvaret var noe vi snakket med samtlige av intervjuobjektene våre om, i tillegg til at flere respondenter trakk problematikken frem i spørreundersøkelsen. Av data-grunnlaget kan det synes at respondentene opplever Forsvaret som en utfordrende arbeidsplattform å søke seg tilbake til. Hva skal altså til for å gjøre Forsvaret konkurransedyktige i kampen om kompetanse?

Et alternativ kan være et system som kartlegger kompetanseutviklingen blant tidligere ansatte i Forsvaret. Det vil være et naturlig sted å synliggjøre vakante stillinger, og samtidig headhunte relevant personell. Et slikt system vil potensielt innhente nødvendig kompetanse raskt, med kortere leveringsfrist enn en utdanning. I hvilken grad Forsvaret kan matche markedslønnen som logistikkutdannet personell får i det sivile er diskuterbart, men som vi også diskuterte med respondentene våre så var ikke nødvendigvis en bedre lønsslipp alene årsaken til hvorfor de sluttet – ei heller trenger det å være avgjørende for at de returnerer.

TIL ETTERTANKE

Underveis i arbeidet med oppgaven opplevde vi et stort engasjement, både i og utenfor forsvarssektoren. For oss har oppgaven blitt et symbol på at villigheten til å dele av sitt kan bidra til en uvurderlig utvikling for fellesskapet. Uten våre 57 respondenter hadde oppgaven vært uten verdi, og deres villighet til å dele har resultert i funnene gjort i oppgaven. Vi håper derfor at denne artikkelen, i likhet med oppgaven, kan være av verdi for videre diskusjon og utvikling av personellforvaltningen i Forsvaret. Det er viktig å aldri glemme hva som er, og som alltid vil være, Forsvarets viktigste ressurs. Forvaltningen av personellet burde derfor prioriteres, hele veien fra sesjon til pensjon.

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Utvikling av militær logistikk for afghanske sikkerhetsstyrker

Lasse Elvemo

Norske spesialstyrker har høstet anerkjennelse for mentorering av afghanske sikkerhetsstyrker. Oppdraget omhandler ikke bare utviklingen av taktiske og operasjonelle kapasiteter, det omfatter også etableringen av en selvstendig stab, organisasjon og støttestruktur, som skal sørge for at de afghanske operatørene kan utføre sitt oppdrag. Oppdraget er i mange tilfeller en form for grunnleggende styrkeoppbygging, og gir også læring tilbake til Norge for hvordan vi utvikler våre løsninger for logistikk.

NORSKE MENTORER – THE NORWEGIAN WAY

Norge har pr mars 2020 fortsatt et engasjement i Afghanistan gjennom NATO-oppgdraget *Resolute Support Mission* (RSM). RSM ble iverksatt i 2015 som videreføring av den flernasjonale styrken *International Security Assistance Force* (ISAF). Det norske styrkebidraget for mentorering består av et team med mentorer i *Task Group 53* (TG-53), og mentorer i den overordnede staben *Task Force 31* (TF-31). Det norske bidraget er rettet mot det afghanske spesialpolitiet – *General Command Police Special Unit* (GCPSU) som består av en håndfull eliteenheter, og mange mindre kontraterrorenheter. Enhetene har tilstedeværelse spredd rundt i hele Afghanistan, og er for alle praktiske formål utstyrt med materiell tilsvarende en militær kontraterrorenhet.

Oppdraget til Norge består i å støtte det afghanske spesialpolitiet med rådgiving og opplæring: *Train, Advice, Assist* (TAA). Oppdraget har innslag i hele organisasjonen (GCPSU), fra enkeltmannsferdigheter og oppdrag i avdeling til styrkeproduksjon og oppdragsløsning på overordnet stabsnivå. Det norske bidraget håndterer i hovedsak TAA av eliteenheten *Crisis Response Unit 222* (CRU222). Anerkjennelse av den norske modellen for TAA som utføres av TG-53 har vært tydelig. Mattingdal (Norsk Militært Tidsskrift, NMT, 3:2019) peker på at *The Norwegian way* er en kontinuerlig tilpasningsprosess som hviler på tålmodige og langsiktige politiske investeringer.

MÅL OM SELVSTENDIG AFGHANSK LOGISTIKK

Kontinuerlig tilpasning og behov for langsiktige investeringer gjelder ikke bare for den utøvende, stridstekniske delen av det afghanske spesialpolitiet og CRU222. GCPSU er som alle andre militære avdelinger helt avhengig av en logistisk understøttelse, som sørger for riktig tilgang på materiell og ressurser. Norge har over flere perioder bidratt med mentorstillinger innen logistikk på utøvende nivå via TG-53, og i et mer overordnet nivå via TF-31. Norske offiserer har generelt bidratt med mentorering innen mange områder i byggingen av operative kapasiteter; logistikk, økonomi, kontrakter, gender, samband, utvikling av trening, seleksjon og kompetanse.

De logistiske løsningene for GCPSU baserer seg på at den afghanske organisasjonen skal forvalte og drifte sitt materiell, under oppsyn og mentorering. Materiellet kommer fra direkte materiellbevilgninger og finansiell støtte for materiellanskaffelser. Det langsiktige målet med GCPSU sin logistikkorganisasjon, er at de evner å drive selvstendige anskaffelses-, forvaltnings-, og vedlikeholdsprosesser for å kunne løse oppdrag. Det inkluderer også evnen til å kunne støtte egne avdelinger med nødvendig materiell i utførelsen av skarpe operasjoner.

USA er den største bidragsyteren, og har etablert *Combined Security Transition Command-Afghanistan* (CSTC-A), som fungerer som en bevilgende og reviderende organisasjon for de afghanske sikkerhetsstyrkene i sin helhet, herunder GCPSU. Mentorens rolle er på mange måter å jobbe med GCPSU, og sørge for at de har gode interne rutiner og et profesjonelt og troverdig samarbeid med CSTC-A, for å bidra til å etablere selvstendighet. De afghanske styrkene skal forvalte materiellet på en bærekraftig måte som gir operativ evne. I takt med at kapasiteten utvikles, og de

afghanske styrkene forsterker sin selvstendighet, skal CSTC-A trekke seg mer og mer tilbake. I praksis betyr det at CSTC-A ivaretar den styrende rollen tilsvarende Forsvarets Logistikkorganisasjon og Forsvarsmateriell har i Norge. Tidsplan for når de afghanske sikkerhetsstyrkene skal oppnå selvstendighet, har ikke vært hugget i stein, og har vært skjøvet på flere ganger i takt med økt erkjennelse om at dette oppdraget tar tid.

LOGISTIKKORGANISASJON

Målsetningen om selvstendighet innebærer at logistikkbransjen til GCPSU (J4 seksjonen) må ha en ganske bred materiellfaglig kompetanse, både for styrke- og kapasitetsbygging og for operativ logistikk. Seksjonen består av erfarne afghanske offiserer og politifolk i lederroller, og alt fra sjåfører til mekanikere og annet støttepersonell. Organisasjonen er forsterket med sivilt ansatte *Subject Matter Experts* (SME), som ofte er språkkyndige (engelsk) afghanere med høyere utdanning innen eksempelvis logistikk, anskaffelser, jus m.m. Under ledernivå er nivået av analfabetisme ofte opp mot 80%.

I J4 seksjonen er det store verdier i både penger og materiell i bevegelse. Afghansk kultur kan i grovt beskrives å være like mengder gjestfri, imøtekommende og pliktoppfyllende som åpen for fleksibilitet og korrupsjon. Forsvarlig forvaltning er et begrep som er forbundet med stor fleksibilitet og kreativitet, og et *sunt* nivå av korrupsjon er en forventet del av ressursforvaltningen. Om man i vestlig sammenheng snakker om flyt av materiell i en forsyningskjede som noe positivt, så innebærer det et nivå av kontroll som vi i vesten nok tar for gitt. Hvis en mister kontroll og synlighet på materiellet, kan en si at en går fra materiellflyt, til at alt materiellet flyter. At materiellet til dels flyter, henger bl.a sammen med en mer pragmatisk tilnærming til hele tilværelsen og en fleksibilitet som har sikret overlevelse i et samfunn som tross alt har sett kontinuerlige omveltninger og krig gjennom generasjoner.

PRAKTISK UTFØRELSE AV LOGISTIKK I AFGHANISTAN

Rent geografisk er det utfordrende å sikre at alle avdelinger i GCPSU har tilstrekkelig materiell og forsyninger tilgjengelig for å utføre oppdrag. En kjøretur fra Herat i vest til Kabul i øst kan ta over 18 timer, og kjøreturen er forbundet med en viss risiko. Forsyning av det meste for drift av leir, inkludert proviant og drivstoff gjøres i all hovedsak gjennom sivile forsyningskjeder som leverer lokalt. Sivile leverandører må også operere i en risikosone, men oppnår sikkerhet ved å forsvinne i mengden av all daglig trafikk, uten at det kan kalles trygt av den grunn. De operative enhetene utfører i all hovedsak oppdrag av relativt begrenset varighet, og er i stor grad selvforsynt i tiden de befinner seg utenfor egen leir. De kan også belage seg på noe støtte fra eksempelvis den afghanske hæren hvis de samarbeider. En hærstyrke har som oftest, etter planen, en sterkere innebygget organisk logistikk, sammenlignet med en kontraterrenhet. Den Afghanske hæren har likevel ikke et utviklet og strømlinjeformet logistikkopplegg som GCPSU kan basere seg på.

Selv om oppdragets natur gjør kravet til logistikk relativt oversiktlig, er det fortsatt nødvendig med forsendelse av militært materiell rundt i landet. Dette kan

være i forbindelsen med vedlikehold, kontroll, etablering av nye kapasiteter og ren etterforsyning av f.eks. ammunisjon. CSTC-A har i perioder krevd at all utlevert nattoptikk skulle tilbake til Bagram (øst) på årlig basis, for resertifisering og kontroll. Dette er i praksis materiell som kan sammenlignes med FMS-materiell i Norge (Foreign Military Sales). Materiellet er derfor underlagt strenge kontrollregimer, som kan være utfordrende å ivareta i Afghanistan. Da det ble regnet på ressursbruken, tidsbruken og risikoen forbundet med å frakte lisensiert materiell rundt i landet på utrygge veier, ble alternative løsninger vurdert. Dette er ett eksempel på at forholdene ikke ligger til rette for at man kan mentorere inn alle vestlige fredstidsløsninger til et land som Afghanistan. Det stiller også spørsmål omkring forskjell på løsninger for fred og krig. I Norge er det et prinsipp at logistikk skal utføres etter samme prinsipper i fred, krise og krig. Det beste vi kan få til er å øve logistikken i mest mulig reelle scenarier. Reell øving av militære forsyningskjeder i et reelt scenario, over reelle tidsrammer, er i mange tilfeller mangelfullt. I Afghanistan, som i praksis er høyrisikosone, må logistikk-løsningene tilpasses etter reelle operative scenarier med én gang hvis de skal virke.

Mye av materiellet og forsyningene er lettomsettelige produkter, som er enkle å utnytte til korrupsjon. Drivstoff kan vannes ut, og det kan føres ekstra ammunisjonsbruk på rapporter etter skytetrening. I samspill med lokale sivile leverandører kan det drives kreativ og dobbel fakturering, og vennskapene og familiebåndene som legges til grunn for inngåelse av forretningsavtaler er ikke nødvendigvis tegnet ned i noe offentlig register. Det ligger i det hele tatt mange forhold til rette for å kunne drive utstrakt korrupsjon, og det er svært utfordrende å få til effektive kontrollerende og motvirkende tiltak. Hvis alle leddene i en forsyningskjede forventer å få noe ekstra, og synes det er helt ok, da finnes det i praksis ikke en rask løsning. Personlig ansvarliggjøring har vist seg å virke i visse deler av organisasjon, i det minste på enkeltmanns nivå. En vet gjerne at ammunisjon, nattoptikk og våpen som selges på det lokale markedet, fort kan peke mot en selv i neste skarpe situasjon. Personlig ansvarliggjøring er en mekanisme som fungerer bedre i eliteavdelinger sammenlignet med eksempelvis hæravdelinger som har større utfordringer knyttet til rekruttering, screening og seleksjon samt desertering (folk slutter). Korrupsjon sies å være årsak til så mye som 70-80% tap i enkelte verdikjeder og forsyningskjeder.

KORRUPSJON SOM FUNDAMENTAL FAKTOR

Korrupsjon er en faktor som fortjener et litt grundigere innblikk, da det er en faktor som påvirker nærmest alle aspekter av Afghanistan som nasjon, og ikke minst byggingen av militære kapasiteter.

Korrupsjon i så stort omfang som i Afghanistan er med på å påvirke det politiske og strategiske landskapet. Korrupsjon foregår gjerne i uformelle maktstrukturer, som for øvrig kan ha likheter med organisasjonsstrukturer i sikkerhetsstyrkene. Det er ikke uvanlig at ledere og evt. mellomledere er de som får størst bit av kaken. Det finnes også eksempler på at høytstående personer i afghansk statsforvaltning har sørget for at familiemedlemmer har fått tildelt stillinger hvor det forvaltes store verdier. Nepotismen er i mange tilfeller veldig synlig, og noen ganger er det med på å etablere nettverk og kommunikasjonslinjer som bidrar til at ting faktisk skjer. For

det er tilfeller hvor målsetningen til de korruperte er sammenfallende med utviklingen av operative avdelinger. Det kan være så enkelt som at en avdelingssjef har et bekjentskap som leverer entreprenørtjenester. Da vil det være en felles målsetning for alle parter at det bygges eksempelvis bygningsmessige sikkerhetstiltak rundt en leir. Korrupsjonen kan slå ut på flere måter; enten at kvaliteten forringes, at arbeidet ikke ferdigstilles, eller at kostnaden for tilfredsstillende leveranse er uforholdsmessig høy. I et slikt tenkt tilfelle vil entreprenøren og avdelingssjefen i samarbeid kunne skumme fløten. Dette kan gjøres så enkelt som dobbel fakturering eller tyveri av utstyr og materiell.

Til en viss grad er denne type korrupsjon til å leve med, spesielt på kort sikt. Mentorer må balansere sin innflytelse i disse svært så mørkegrå nyansene, ikke minst fordi sikkerheten til mentoren i stor grad er i direkte sammenheng med kvaliteten på relasjonene de evner å bygge.

Mentorer har i flere tilfeller bidratt til å minke korrupsjon. Da er det gjerne gjort gjennom bygging av tette relasjoner og en detaljert oppfølging. Hvis dette i tillegg bidrar til synlig anerkjennelse av de afghanske parters involvering, så kan det i sum bidra til å etablere flere ikke-korruperte prosesser. På den andre siden finnes det også eksempler på afghanske offiserer som har bidratt svært effektivt i å begrense korrupsjon, som på litt sikt har blitt fjernet fra sin stilling. Hvis neste ledd i kommandolinjen taper på at ansatte motvirker korrupsjon, så er motivasjonen klar for å fjerne vedkommende. I noen tilfeller peker omstendighetene mot at enkelte afghanske offiserer har blitt utsatt for komplott for å få de fengslet, hvorpå de blir erstattet av mer korrupsjonsvennlige personer. Slike omstendigheter gjør jobben som mentor krevende.

På lang sikt er det helt nødvendig å bekjempe korrupsjon for å klare å bygge troverdige og virkningsfulle sikkerhetsstyrker. Korrupsjon er i mange tilfeller medvirkende drivere til konflikter og må sees i sammenheng med den generelle sårbarheten til en nasjon som helhet. Korrupsjonen foregår der ressurser allokeres, og kan derfor være viktig faktor for å forme politisk landskap og oppbyggende for en liten elite. De som tjener på korrupsjonen har insentiver som på sikt er i direkte konflikt med utviklingsmål for nasjonen, både når det gjelder politisk organisering og etablering av sentral infrastruktur. Korrupsjon er derfor til slutt et politisk problem, som er sammenflettet med kulturen.

KULTUR OG KOMPETANSE FOR Å DRIVE MED LOGISTIKK

Det er ikke bare når det gjelder korrupsjon av kulturen har stor innvirkning. Kontroll kan sies å være uttrykk for kultur, og kontroll er helt sentralt for all utøvelse av logistikk, om man er i Afghanistan eller i Norge. Vårt vestlige samfunn er drifet av sammenhengende forsyningskjeder, hvor juridiske forhold stort sett er ryddig og materiellet er synlig i IKT systemer. Vestlig kontroll på just-in-time logistikk gir muligheter for å kutte svinn og drive effektivt. Materielkontroll begynner på enkeltmanns nivå, og må være satt i system for avdelings- og organisasjonsnivå hvor datamengden raskt blir stor. Kontroll på en viss mengde data krever enten betydelig analoge ressurser, eller digitale verktøy som eksempelvis Excel eller ERP systemer. Bruk av Excel fordrer tilgang til datamaskiner, at det er stabil tilgang til

elektrisitet og ikke minst at en har kompetanse til å bruke Excel. Dette er ressurser vi tar for gitt i vesten, hvor det er knapphet i Afghanistan. Forvaltning av datakvalitet kommer heller ikke av seg selv, det er noe en ikke trenger å reise til Afghanistan for å erfare. Materiellkontroll fordrer også at de som teller materiell kan regne med pluss, minus og noe multiplikasjon. Hvis en ønsker en viss grad av sentralisert kontroll, er det også nødvendig med nettverkstilgang. Bygging av kapasitet for logistikk innebærer derfor utvikling av skrive- og leseferdigheter, elementære dataferdigheter og ikke minst en hensiktsmessig balanse mellom kontroll, tillit og kultur for å ta var på materiellet.

Oppdraget er å etablere GCPSU som organisasjon med en sentralisert kontroll på materiell og prosesser, basert på en vestlig modell. Organisasjonen som trenes er vant til utstrakt desentralisert ansvar for nærmest alle aspekter av tilværelsen, kanskje bortsett fra den ideologiske retningen. Afghanerne har vært vant til at svært mye foregår muntlig. I koalisjoner mellom krigsherrer, har det vært lokal (desentralisert) kontroll på det aller meste av ressurser, og de svært flyktige maktstrukturene har vært basert på tradisjoner, familie og relasjoner. Dette er hardføre mennesker, som har overlevd svært krevende omgivelser, som vi nå ber innføre en stabil organisasjon, som har svært ressurskrevende kontrolltiltak med til dels teknologisk avansert utstyr. Dette er ikke gjort i en håndvending.

FOR WANT OF A NAIL – ELLER BATTERIER.

Behovet for kontroll, eller konfigurasjonsstyring gjelder for hele spekteret av teknologi, fra sammensatte våpensystemer til enkle ting som batterier. Ved innføring av teknologi som samband og nattoptikk til det afghanske spesialpolitiet, er det nødvendig med bl.a. batterier. Batterier til samband er gjerne oppladbare og lagt under merkantil kontroll av en vestlig mentor og vestlige kontraktører. Disse kontraktørene driver både teknologisk og konseptuell utvikling av sambandsbruk. Det har vist seg å være mulig å få til lokal ansvarliggjøring av materiellet blant skarpe afghanske avdelinger. Avdelingene samarbeider i slike tilfeller kun med vestlige kontraktører som driver opplæring og vedlikehold. Med få involverte aktører og god kompetanse, kan en over tid bygge en virkende selvstendig afghansk kapasitet for eksempelvis samband. Utfordringene blir større når de afghanske støtteorganisasjonene selv skal sørge for kontinuitet og langsiktig operativ tilgjengelighet i materiellparken. Dette ble tydelig ved etablering av kontrakter for å anskaffe standard batterier til forbruk.

For AA/AAA o.l. batterier til bl.a. nattoptikk og lykter ble det iverksatt en anskaffelse som skulle være helhetlig styrt av den afghanske organisasjonen. Det ble inngått en kontrakt med en indisk leverandør, og tilgangen til batterier nådde tilsynelatende tilstrekkelige nivåer. Ved nærmere innsyn i kontrakten, ble det funnet svakheter ved kravspesifikasjonen og generelt stod ikke pengesummen i stil med leveransene. Batteriene viste seg å være svært ustabile. De var lette og myke og kunne i praksis drifte nattoptikk ned mot 10-15 minutter. Dette er uheldig hvis du er en operatør som skal gjennomføre en viktig arrestasjon i mørket. Selv de enkleste teknologiske tilskudd til en organisasjon er avhengig av en viss organisatorisk støttestruktur som sikrer kvalitet og ytelse hvis det skal bidra til operativ evne. I et vestlig land handler slike problemstillinger kanskje om avanserte

sensorer, effektorer og kjernereaktorer. Prinsippene for logistikkens rolle i en militær verdikjede er dog de samme – og djevelen ligger alltid i detaljene. Ordttaket om hesteskoen som gjorde at kongeriket falt, har skriftlige referanser tilbake til 1200 tallet, og virker å ha samme praktiske relevans for militære organisasjoner i moderne tid.

For the want of a nail the shoe was lost,
For the want of a shoe the horse was lost,
For the want of a horse the rider was lost,
For the want of a rider the battle was lost,
For the want of a battle the kingdom was lost,
And all for the want of a horseshoe-nail.

REVOLUSJON ELLER EVOLUSJON?

Militære organisasjoner av en viss størrelse som har tilgang til teknologi av en viss kompleksitet, er avhengig av en systematisk støtte, en ryggrad med en viss stabilitet for å sikre at den spisse enden har gjennomslagskraft. Med økt kompleksitet kommer økt krav til kompetanse, og til at leddene i kjeden har en viss balanse i kapasitet. Afghanerne er flinke til å håndtere svært skiftende og komplekse maktnettverk på en muntlig måte, men det er ikke dermed sagt at de håndterer kompleksiteten i henhold til en vestlig standard. Selv om man hadde bygget kunnskap for å kunne bygge velfungerende og komplekse forsyningsnettverk, kan en se for seg at kunnskapen ville vært brukt til å effektivisere praksisen med systematisk korrupsjon. Kultur spiser ofte strategien til frokost, og det er liten tvil om at kulturelle endringer krever tålmodige og langsiktige investeringer.

Det betyr at man må bygge kapasitet og løsninger som er tilpasset kulturen og tilgjengelig kompetanse. Hvis man velger å bygge en low-tech, analog organisasjon, med høy grad av desentralisert styring, risikerer man at de flyktige makstrukturene ikke nødvendigvis følger sentrale målsetninger, og det kan bety at en pumper ressurser ut i et system designet for å feile fra et vestlig perspektiv. I visse avdelinger i afghanske sikkerhetsstyrker har man sett nettopp dette.

Når man har valgt å etablere en sentralt styrt organisasjon, med et visst teknologisk nivå, så må det som sagt store kulturelle og kompetansemessige omveltninger til for at en slik organisasjon skal kunne bli selvstendig. Suksessen til the Norwegian way er basert på en kontinuerlig tilpasningsprosess som hviler på tålmodige og langsiktige politiske investeringer. Dette gjelder erfaringsmessig for de taktiske enheter, og det gjelder kanskje enda mer for den delen av organisasjonen som skal sørge for at de riktige ressursene er tilgjengelige for at operatørene skal kunne gjøre jobben sin.

PARALLELLER TIL NORGE

Norsk militær logistikk er svært mye mer kompleks sammenlignet med afghansk militær logistikk. Samtidig hviler den logistiske kapasiteten på noen faktorer som er felles for begge nasjonene, og det er mulig å trekke lærdommer begge veier mellom nasjonene. Følgende er noen faktorer som kan eksemplifisere dette:

Økt kompleksitet fordrer økt kompetanse. I Norge er OMT et tiltak for å bidra til mer riktig kompetanse på riktig sted. Samtidig har Forsvaret vært gjennom en omlegging- og kuttreform i utdanningssektoren, hvor en i praksis ender opp med at mye personell skal gjøre samme jobb som før, med kortere utdanning. Dette er en risikabel utvikling hvor en ikke ser effekten på kort sikt. Faglig kompetanse er dessuten en katalysator for kreativitet, som kan ha direkte effekt i møte med friksjon.

Logistikken må trene og utvikle konsepter sammen med avdelingene de skal støtte, i situasjoner som er mest mulig realistiske.

En fugl i hånden er bedre enn ti på taket. Reell materiellberedskap skaffes enten gjennom synlighet i robuste forsyningskjeder, eller gjennom lager. I Norge skal lagre minimeres, og vi stoler på at forsyningskjedene er robuste, uten å nødvendigvis vite det.

Kvaliteten i IKT systemene, herunder datakvaliteten, har en direkte innvirkning på operativ kapasitet og tilgjengelighet.

Outsourcing av kapasiteter skaper avhengighet, noe en må være bevisst på kan få konsekvenser for utførelsen av oppdrag. Dette gjelder forsynings-sikkerhet for alle forsyningsklasser, inkludert sanitet, service og tjenester.

Nivået av ressurser en må legge til for å ivareta kontroll i forsyningskjeden, er i direkte sammenheng med kultur, orden og tillit i nasjonen for øvrig.

Uten særskilte tiltak innen militære forsyningskjeder, så vil den militære logistikken ha den samme eller dårligere forsyningsikkerhet som det sivile samfunn. Forsvaret skal virke når strukturene ellers i samfunnet mister kapasitet eller faller fra. Hvis helheten av militære forsyningskjeder kun baserer seg på den sivile forsyningskjedens robusthet og resiliens, så vil Forsvarets ytelse gå ned i takt med resten av samfunnet.

OPPSUMMERING

Den amerikanske hærens feltmanual for COIN operasjoner tilbyr en god oppsummering når det kommer til å bygge militær logistikk i Afghanistan. Logistikkfunksjoner er antageligvis de funksjonene det vil ta lengst tid å etablere i en vertsnasjon. Logistikkfunksjonene er gjennomsyret av innebygget kompleksitet og potensielle kulturelle utfordringer. Derfor vil vertsnasjonens styrker bruke lang tid for å evne å operere uavhengig av amerikansk og generelt multinasjonalt logistikkstøtte. Dette er i tråd med *the Norwegian way*, som er en kontinuerlig tilpasningsprosess som hviler på tålmodige og ikke minst langsiktige politiske investeringer.

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Operational Contract Support (OCS) – An Introduction

Tore Listou
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INTRODUKSJON

Multinational Capability Development Campaign (MCDC) er et USA-ledet (US Joint Staff J7), multinasjonalt samarbeid innenfor militær konsept- og kapabilitetsutvikling. Den overordnede hensikten er å utvikle og validere nye konsepter og kapabiliteter («non-material solutions») for å øke den operative effekten til en multinasjonal koalisjonsstyrke.

MCDC følger en to-år syklus, der de 24 medlemslandene etablerer multinasjonale prosjekter for å undersøke relevante problemstillinger. I syklus 2017-2018 ble prosjektet «*Global Integrated Logistics for Rapid Aggregation*» (GILRA) etablert, basert på følgende problemformulering:

«The global logistics community partnerships have inadequate capability to assess and respond to global integrated operations, through globally integrated logistics, in complex A2/AD environments. A significant proportion of supply chains lie outside of military control. This requires further development of doctrines, operations concepts, organizational constructs, and guidelines that align supplier resources with military capabilities in order to enhance operational effects».

Prosjektet ble ledet av FHS/Stabsskolen i samarbeid med US Joint Staff / J7, med prosjektdeltakere fra Norge, Finland, Sverige og USA samt observatører fra Canada, Nederland, Danmark, UK og Japan. Prosjektets mål var å utvikle *“a strategic-to-operational level integrated logistics approach incorporating recommended future operational concepts and organizational constructs that the Joint Logistics Enterprise (JLEnt) can incorporate in applicable DOTmLPP-PI capabilities. Product development will be aligned with Multinational partner logistics areas of interest in areas such as Prepositioning (PREPO), Operational Contractor Support (OCS) process, procedures, and Technology Infusion in areas of Additive Manufacturing (AM)/Autonomous System (AxS) logistics delivery systems in support of Globally Integrated Operations (GIO). This will result in an improved ability for JLEnt Community of Interest (COI) members to assist in rapid force aggregation and integrated and distributed logistic implementation”.*

DOTmLPP-PI (*Doctrine, Organization, Training, materiel, Leadership, Personnel, Facilities – Policy, Interoperability*) er hentet fra US DoD Joint Capabilities Integration Development System. MCDC-prosjektene tar for seg ‘non-material solutions’.

Hvert delprosjekt er dokumentert i egne rapporter i MCDC rammeverket. I det følgende presenteres Delrapport I om samarbeid og koordinering mellom den sivile (kommersielle) og militære delen av militære forsyningskjeder.

MCDC /OCS - PURPOSE AND AIM

The purpose and aim of this paper is to present suggestions for innovations and improvements to maximize logistics efficiency and effectiveness when leveraging Operational Contract Support (OCS). In order to achieve this, the paper will:

- a. Establish the principles of Operational Contract Support (OCS) by drawing upon central tenets from US and NATO doctrine.
- b. Describe the As-Is situation of OCS as it is currently practiced in the NATO member country Norway.
- c. Suggest improvements and innovations for an enhanced and more efficient use of OCS by developing an appropriate Use Case and associated Operational Concept that allows for testing during Exercise VIKING and other relevant activities.¹

This paper takes as its point of departure that the use of OCS will increase due to current trends in military logistics, and that this fact will represent both possibilities and challenges for defence organizations.

Although the *principles* presented in this paper derive from US Joint Doctrine and/or NATO doctrine, the use case is based on *current practice* in the Norwegian Armed Forces. During the past years, the Norwegian Defence Logistics Organization (NDLO) has embarked on an expansive programme to more extensively use civilian contractors in the military supply chain for the Norwegian Armed Forces, an effort that is unprecedented in a NATO context. Using the Norwegian experiences as an example, this paper aims to present a Use Case and Operational Concept that build on this experience while also being broad enough as to be applicable for other nations' armed forces as well.

BACKGROUND

According to the US Joint Publication (JP) 4-10 *Operational Contract Support*, "[t]he US has always used contracted support in military operations at various levels of scope and scale."² The same can be said for armed forces in all other NATO countries. However, there is no doubt that the use of civilian contractors in the military supply chain has expanded rapidly during the last few years.

According to writers such as Dr. Peter Warren Singer, the trend towards privatization in the military sphere is part of a much larger trend where the state is abandoning its once all-commanding heights, opening up new areas for privatization and profit-seeking ventures. This he claims, is best described as "a normative shift in worldview",³ and also a part of a global pattern, "*one of growing reliance by individuals, corporations, states, and international organizations on military services supplied not just by public institutions but also by the non-sovereign private market. The changes that this phenomenon portends are tectonic. The emergence of a privatized military industry may well represent the new business face of warfare.*"⁴

¹ Please note that this document is not comprehensive or authoritative, and users are advised to continue their studies using the documents, books and doctrines mentioned in the text as a starting point.

² Joint Publication (JP) 4-10 *Operational Contract Support*, version dated 16 July 2014, p. ix.

³ P. W. Singer, *Corporate Warriors: The Rise of the Privatized Military Industry* (Ithaca and London: Cornell University Press, 2003), p. 68–70.

⁴ Singer, *Corporate Warriors*, p. 18.

Although Singer's argument is mainly based on the emergence of private companies in the security sector, the trend towards privatization is also apparent in logistics. However, according to the JP 4-10, the reason for this development is more prosaic: "In recent operations, the use of contracted support has been at the very high end [...]. The continual introduction of high-tech equipment, coupled with force structure and manning reductions, mission specific force cap restrictions, and high operating tempo, means that contract support will augment military forces in most operations."⁵

The 2015 US Joint Staff *Joint Concept for Logistics* therefore identifies what is billed "the Logistics Gap" [...] a disparity between logistics demand and logistics resources".⁶ The reason for this Logistics Gap follows from these five on-going trends:⁷

- The increasing logistics demand of modern military forces and operations
- Constrained resources, both overall and within the logistics force structure
- The growing complexity of logistics operations
- The proliferation of advanced anti-access/area-denial capabilities by adversaries that would degrade logistics capabilities and capacities
- Increasing cyber threats to logistics networks and mission systems

One vital component to meet these demands successfully is to develop processes and routines for OCS further.

FRAMEWORK – PRINCIPLES FOR OCS

Historically, there are numerous instances where OCS has been applied successfully so that military forces has been able to draw upon the existing resources of civilian society in such a way that these resources function as a force multiplier. One example is NORTRASHIP (the Norwegian Shipping and Trade Mission), a Norwegian shipping organization consisting of the 85 % of the Norwegian ships not in harbour at moment of German invasion April 9th, 1940. These ships were requisitioned by the Norwegian government, which then formed the organization. At the time, it was the world's largest ship-owner with about a 1000 ships, which then made up a major part of the Norwegian war effort for the Allies for the duration of the war.⁸

However, there are also instances where over-reliance on civilian contractors has had potential disastrous effects on operations. One such example is when the contracted military transport ship GTS *Katie*, sailing from Bosnia in July 2000 with

⁵ JP 4-10, p. I-1

⁶ *Joint Concept for Logistics (JCL), Version 2.0, 25 September 2015, p. vi.*

⁷ *Derived from JCL, p. v–vi.*

⁸ *Hans Fredrik Dahl et al, Norsk krigsleksikon (Oslo: Cappelen 1995), s. 302–303; <https://no.wikipedia.org/wiki/Nortraship>, accessed 16 January 2018.*

a load consisting of a Canadian Army unit, 550+ vehicles as well as 350 containers of ammunition and other sorts of equipment, refused to dock due to a financial dispute between two subcontractors to the Canadian Army. During a standoff that lasted for nearly two weeks, almost one-third of the entire Canadian Army's equipment and soldiers were unavailable.⁹ It is therefore essential to conduct OCS according to established principles and that cooperation with civilian contractors is entered into only after a thorough consideration process.

JP 4-10 defines OCS as "the process of planning for and obtaining supplies, services, and construction from commercial sources in support of joint operations".¹⁰ In order to be successful, OCS therefore requires a programmatic approach from commanders, military units, and combat support agencies and contracting entities, ideally continually and routinely exercised in training, domestic, or non-combat related missions. While JP 4-10 states that most joint operations will include support from civilian contractors and that OCS can be a significant force multiplier, it also stresses that OCS typically is only one of several sources of support for a given operation. JP 4-10 also emphasizes the importance of integrating contractors early in the planning process.¹¹

a. NATO principles of OCS

Although NATO doctrine uses the term Contractor Support to Operations (CSO), the Alliance concept of Operational Contract Support is more or less the same as the one found in US Joint Doctrine, and in documents such as *NATO Logistics Handbook* and Allied Joint Publication (AJP) 4-9, *Allied Joint Doctrine for Modes of Multinational Logistic Support*. NATO doctrine states that OCS/CSO should be considered when:¹²

- the military manpower strength in a national contingent or in a Joint Operations Area (JOA) is limited by a political decision;
- the required capability is not available from military sources;
- the required capability has not been made available for an operation;
- the military capability is not available in sufficient numbers to sustain an operation;
- the military capability is required for other missions; and/or
- the use of local contractors supports an agreed Civil-Military Cooperation (CIMIC) plan;
- the use of contractors (civilians or local labour) for certain functions, and at certain times may be more cost-effective; and
- there is an operational need for continuity and experience that cannot be provided by using military manpower on a rotational basis.

⁹ Singer, *Corporate Warriors*, p. 160.

¹⁰ JP 4-10, p. ix.

¹¹ JP 4-10, p. x.

¹² *NATO Logistics Handbook*, p. 157–158.

In order to be successful, NATO policy dictates that operational requirements are paramount, and are to have primacy above all other considerations. The policy also calls for cooperation, visibility and transparency, interoperability, and integration of force planning and force generation, all the while ensuring the NATO Commander's authority and control in the most effective manner. Planning is essential, and successfully applied, OCS can release military manpower for other tasks. As for the legal status of contractors, NATO policy defines this as "Civilians accompanying an armed force", thereby being eligible for POW status.

Generally, NATO policy states that OCS can be applied in either technical and/or support services. Technical services can include "contractor logistic support (CLS) set up and maintenance of weapons systems, operation and maintenance of communications, health care, technical CIS services and automatic data processing (ADP) support, in-theatre technical training, and expert advice, such as that provided by national functional experts and technical staff of NATO agencies."¹³

Support services, on the other hand, includes "strategic transport, strategic aeromedevac, air-to-air refuelling, operation of sea/air ports of disembarkation, air traffic control, fire fighting, base camp construction and maintenance, fuel storage and distribution, infrastructure engineering, certain aspects of support to health services, ground transportation, maintenance and repair, recovery, environmental services (sanitation, refuse, salvage), provision of food and water, and local labour."¹⁴

US Joint Doctrine differentiates somewhat differently, between Theater Support, Systems Support and External Support. Theater Support contracts are awarded locally in the operational area by contracting officers, and typically involve local contractors performing services such as supplies, services and minor construction works. Systems support contracts are awarded by higher echelons and typically involve support for newly fielded weapons systems. External support contracts are comprehensive programs that often involve contractors from many nationalities, such as the Army Logistics Civil Augmentation Program (LOGCAP).¹⁵

b. NATO – Planning in OCS

As mentioned above, NATO doctrine stresses the need to identify and plan for OCS requirements early on in any operation. Applied successfully, OCS may release manpower for other tasks.¹⁶ Planning and exchange of information between participating countries is essential, as well as ensuring that the civilian contractors are involved in the planning process in order to advise and scope courses of action (CoAs) as early in the operation as possible. Moreover, NATO doctrine calls for integration between the military force and the supporting civilian contractors at all levels of operation during the planning process – strategic, operational and tactical.

¹³ *Allied Joint Publication (AJP) 4-9, Allied Joint Doctrine for Modes of Multinational Logistic Support, p. 6-2.*

¹⁴ *AJP 4-9, p. 6-2.*

¹⁵ *JP 4-10, p. 1-7.*

¹⁶ *NATO Logistics Handbook, p. 158.*

To do this, NATO doctrine calls for the appointment of a Contract Integrator (CI), with the task of assisting the relevant military headquarters in the planning and implementation of operational contract support.¹⁷

The planning process must identify areas eligible for use of OCS, as well as challenges related to interoperability, Command and Control (C2), as well as the legal status of the force by conducting OCS. During the risk assessment process, these challenges must be addressed. In preparation for the operation, the Joint Force Commander (JFC) is responsible for ensuring that requirements for training, deployment, force protection, health and safety of contractor personnel are established. The individual contractors are responsible for meeting these requirements.

According to NATO doctrine, the C2 arrangements during operations pertaining to contractors depends on their funding. If NATO funds an OCS contractor for its own support, the JFC has full control of its operations. However, if an OCS operator is funded by a Supporting Nation for national or multinational use only, then the JFC authority is regulated by terms established in the individual contracts.

c. US doctrine: Requirements determination and Contractor vetting

The JP 4-10 states that "Effective and efficient contracted support is driven primarily by timely and accurate requirements. Identifying, synchronizing, and prioritizing requirements are essential precursors to effective contract development and are essential to ensuring the subordinate JFC receives contract support at the right place, at the right time, and at reasonable cost." The requirements determination process involves developing, coordinating, validating, approving and prioritizing the operational contract support requirements. However, requirements determination is not a contracting activity function, but an operational command function primarily performed at the tactical level.¹⁸

Once the OCS Requirements of a given operation has been developed and defined, a thorough vetting process must be performed in order to ensure that the most suitable contractor is chosen. A combination of operational requirements, monetary considerations, time available, contractor skills and past performance will determine this process, which must adhere to established guidelines issued by government, military and/or alliance authorities.

d. Types of contracts in NATO doctrine

In order to regulate operations between military units and OCS contractors, a number of different contracts are possible, depending on the contracted task and overall operational situation. NATO doctrine lists the different types of contracts as follows:¹⁹

¹⁷ NATO Logistics Handbook, p. 162.

¹⁸ JP 4-10, p. xiii and I-4.

¹⁹ AJP 4-9, p. 6-3.

1. Technical Support Contract: Provides for industry specialists to accompany the force for the purpose of providing technical advice or support.
2. System Support Contract: Provides CLS as part of a contract to deliver, implement, and maintain weapons systems and equipment for part or all of their life cycle
3. Lease Contract: Provides a capability for the exclusive use of the customer, for predefined purposes, typically at fixed cost arrangements often with an option to buy.
4. Partnering Arrangement with a Prime Contractor: Normally negotiated on a long-term basis. The prime contractor will subcontract individual elements of support as required.
5. Dormant Contract: Requires a contractor to deliver specified goods and/or services, but its execution is postponed until the specified goods and/or services are actually required.
6. Assured Access Contract: Legally binding a contractor to provide a required capability to NATO as a priority when needed.
7. Preferred Use Contract: Declares, by letter of intent, the willingness of a contractor to provide a required capability after tender when needed.
8. Ready Invitations for Bid: Prepared and kept current, but only issued to potential contractors if, and when requirement occurs.
9. Basic Ordering Agreement (BOA): Used by NATO agencies to provide a 'call-off' capability in which multiple users can draw on a single contractual arrangement with a particular supplier.
10. Spot Market Acquisition: Contracts for goods and services which are readily available on the market and do not require arrangements to be put in place in advance.

e. Contractor management in US doctrine

According to the JP 4-10, "Contractor management is a shared responsibility between the JFC staff, requiring activity, supported unit, base commander, and supporting contracting officer." The principal aim of Contractor management is to ensure that any given service established by contract and performed by OCS is delivered according to the terms and conditions established in the contract, but also focus on how OCS personnel and equipment can be integrated into the overall force structure in such a way to advance operational goals. Contractor management therefore includes both managing the performance of OCS operators according

to the given requirements specified in the contracts, but also must consider and manage governmental responsibilities relating to the use of contractors, such as force protection and other types of support. This means that in addition to formal administrative procedures, contractor management also needs to be performed in the relevant staff and command structures and their processes.²⁰

CURRENT AS-IS SITUATION IN THE NORWEGIAN DEFENCE

With the stated intent of US and NATO doctrine in mind, we will now explore the situation as it currently is in the Norwegian Armed Forces. For many services, the logistics concept is currently being revised, with revised documents published within the next few years. However, the Norwegian Home Guard has already implemented its revised logistics concept, and we will use that concept as an example after we have looked into how contracting is currently done in the Norwegian Armed Forces.

- a. Overarching principles for use of civilian contractors in the NDLO.

According to the NDLO, the inherent military logistics resources in the Norwegian Armed Forces are inadequate to supply the logistics needs of the defence sector. In order to achieve adequate logistics resources, the Norwegian Defence Forces therefore must draw upon the resources of the entire civilian society and leverage the speed, innovation, capacity, and worldwide integration to close the existing logistical gaps. This is to be done within the boundaries of the modernized Total Defence concept, encompassing all sectors of Norwegian society with extensive cooperation on all levels.²¹

Consequently, military logistics is an extension of civilian supply lines, routed towards the military end user. This means that factors influencing Norwegian civilian logistics also will apply to military logistics. The relationship is reciprocal, however, which means that civilian contractors increasingly will play a more central role in terms of readiness, endurance and reliability of supply.²² In the following, we will explore how this influences contracting between the NDLO and civilian contractors and its implication for peacetime operations in Norway.

- b. Contracting in the Norwegian Defence Logistics Organization (NDLO).

Currently, nearly all contracting between the Norwegian Defence Forces and civilian private companies is performed centrally by the NDLO Strategic Procurement Division. The basis for contracts is the Norwegian state framework agreements. In all, the Norwegian Logistic Operations Centre (NORLOGC),

²⁰ JP 4-10, p. 1-5.

²¹ Dept. of Defence, *Guidelines for logistics in the defence sector (January 2016)*, pp. 5, 18–20, 22–23.

²² NDLO, *Concept for logistics in the Norwegian Armed Forces*, pp. 8–10.

which is responsible for the logistic day-to-day operations, can draw upon 500 different framework agreements. The first framework agreement (with WilNor Governmental Services; WGS), dates back to 2015. This is a wide-ranging contract, consisting of five main pillars intended to cover most likely areas of logistical support by civilian operators. These are:

- Joint Coordination cell
- Home Guard (HG) Logistics
- Host Nation Support
- Support bases along the Norwegian coastline
- International port services.

From August 2017, the NDLO established a second, wide-ranging framework agreement with Grieg Strategic Services (GSS), which also provides logistics services, as well as port services in Norway. In addition, both the WGS and GSS have set up coordination cells with the NORLOGC, collocated with the NORLOGC at Kjeller outside Oslo.

These agreements establish a formalized mode of contracting, outlining the required service, offer and acceptance of offerings, before deliverance is conducted. The services are time sensitive, meaning that shorter time between order and deliverance means higher risk premiums and therefore higher prices. The agreements state that the supplier has an absolute obligation to deliver the contracted services, and *force majeure* exceptions are not included in the agreements, which are valid for 7 years at a time.

Locally, the military commanders only have a limited fiscal authority to contract with civilian actors, the maximum amount being 100.000 NOK (approximately 10.000 USD/EUR). Most of the time, without an immediate increase to this maximum fiscal authorization, civilian contractors employed in a given area therefore will be the ones that already have a relationship with the NDLO through framework agreements.

Civilian actors such as WGS and GSS are supposed to be involved in the planning process, especially through the coordination cells. Also, a new ICT tool, HOBS – Host Nation Ordering- and Billing System – is meant to facilitate and streamline the process of ordering logistical assets during operations. The HOBS system was developed and already implemented by WGS, and tested operationally during Exercise TRIDENT JUNCTURE in the fall of 2018.

Including civilian actors in the NORLOGC decision processes is a sensitive area. Both due to Command & Control issues, but also because of the need to limit the access to defence classified information, commercially sensitive information, and to avoid conflicts of interest, such as situations where service providers in practice would be ordering their own services. The executive units of the NORLOGC, the Regional Logistic Groups (RLGs), located in the four main regions of Norway (RLGs North, Middle, West and East), therefore only to a lesser degree liaise with civilian contractors. One challenge, however, is that by excluding vital actors in the military supply chain from the decision process, the military commander at times will have to pay a higher risk premium – both in terms of readiness and in economic costs. However, there is one current example of civil-military logistics

cooperation that has been deemed a success, namely the logistics concept of the Norwegian Home Guard.

c. Current As-Is Situation in Norwegian Home Guard (HG).

The HG logistics concept is a modularized, container-based system, heavily reliant on civilian contractors. Normally, WGS and GSS provide logistics for the HG during exercises and operations. The concept's main principle from a logistical point of view is "Push logistics", enabling contractors to respond to pre-planned demands. At the core of the system are long-term contracts with civilian contractors responsible for the packing, storage and delivery of pre-packed containers at given sites once alarm is raised. The concept states that HG organic logistics shall be restricted to the bare minimum, and that the rest of the logistics to be performed by the NDLO,²³ leaning heavily on contractors.

As the concept states: "The concept is based on broad use of civilian suppliers of materiel and services in all classes of supply, transport, distribution and maintenance. Civilian suppliers will be considered where this is cost efficient and in accordance with laws, regulations, doctrines, own and allied policy, as well as ethically sound. The connection between resource allocation and change of operational ability is the basis for evaluation of cost efficiency."²⁴

In essence, the concept bases itself very heavily on deliveries from other actors, both civilian and military. Although not unproblematic – for example, the Home Guard states that it will rely on transport "requisitioned from the other service branches" in case of operations, as well as ICT integration with the civilian contractors –²⁵ the concept has been deemed a great success, and especially its modularized, pre-packaged containers is looked upon as a leading example that will form the foundation of the on-going revisions of the logistics concepts in the other service branches of the Norwegian Armed Forces.

However, one crucial factor to address is undoubtedly the need of closer coordination between all relevant parties. So far, this work has only just begun in Norway at the NORLOGC, with the most important coordination agencies between the civilian and military actors being the before mentioned NORLOGC coordination cells.

d. Contracting/Coordination in the JLSG/NSPA cells.

As a NATO member, Norway is able to draw upon services provided by the NSPA (NATO Support and Procurement Agency), especially in international operations. The NSPA provides transportation, fuel delivery and a number of logistics services, depending on demand, and functions as Contract Integrator (CI) during operations, thereby coordinating the efforts of contractors during operations. Generally, NSPA operates based on BOA agreements. The Operational Logistics

²³ *Concept for Logistics in the Norwegian Home Guard, p. 4.*

²⁴ *Concept for Logistics in the Norwegian Home Guard, p. 10.*

²⁵ *Concept for Logistics in the Norwegian Home Guard, pp. 15 and 18.*

Support Partnership (OLSP) is the operational branch of the NSPA, and in essence a planning cell to promote use of the NSPA. The OLSP holds biannual meetings.

Another very important NATO body for logistics is the Joint Logistics Support Group (JLSG). The JLSG "is a logistics-centric, force generated, deployed, component-like joint organization, discharging operational-level responsibilities, through joint logistic operational and tactical-level activities; its commander acts at the same command and control level as a component commander."²⁶ The JLSG consists of COM JLSG, JLSG HQ, HQ support, units and resources.²⁷ In order to source the JLSG appropriately in order to enable scalability and readiness, a modular approach is essential.²⁸

Currently there are two permanent JLSGs, one in Brunsum and one in Napoli, both manned by cadre personnel. These will be supplemented by a standing JLSG leadership cell at SHAPE, consisting of about 60 personnel. During operations, the JLSG is the tactical logistics command under J4, and provide theatre level logistics support, as well as military engineering services. The NSPA can fill the role of, or support the Theatre Head of Contracts in the JLSG during operations.

The main purpose of the JLSG is to optimize logistic principles such as those pertaining to OCS and/or multinational cooperative logistics, in order to:²⁹

1. Coordinate the forces' collaboration on logistics with partners and the HN(s)
2. Enhance overall Logistics C2
3. Improve logistic prioritization to meet the Commander JTF's operational objectives
4. Enable economies of scale and reduce costs
5. Avoid resource hoarding and competition for resources both locally and globally
6. Enhance logistic information flow and assessment
7. Enhance collective bargaining power
8. Allow tailoring of National Support Elements (NSEs) to optimize the logistic footprint
9. Improved operational asset visibility for the Commander JTF
10. Make best use of specific national logistics expertise and hardware
11. Enhance coordinated use of logistic infrastructure
12. Through a POL-dedicated coordination cell, manage theatre level petroleum support
13. Integrate capability provided by the NSPA
14. Use Common funding more efficiently
15. Enable coordinated and efficient deployment, relief in place (RIP) and redeployment operations
16. Coordinate the forces' collaboration on logistics with IOs, GOs and NGOs.

²⁶ AJP-4.6(C) 'Allied Joint Doctrine for the Joint Logistic Support Group', p. 1-1.

²⁷ AJP-4.6(C), p. 1-2.

²⁸ AJP-4.6(C), p. 1-3.

²⁹ NATO Bi-SC Joint Operational Guidelines; Joint Logistics Support Group, dated May 2016.

The Norwegian NORLOGC structure is based on the principles of the JLSG. In case of an Allied operation in Norway, the NORLOGC will coordinate extensively with the JLSG in order to operate on the same level and complement each other during operations and in a hypothetical Article 5 NATO operation on Norwegian soil, the NORLOGC will be directly integrated into the JLSG.

e. OCS in US-led multinational operations – the OCS Integration Cell (OCSIC)

In US-led multinational operations, the OCS effort will be coordinated through the OCS Integration Cell (OCSIC), which "is the key organizational element to effective and efficient OCS planning and integration. The primary task of the OCSIC at both the GCC and subordinate Joint Force Commander (JFC) level is to lead the OCS planning and execution oversight effort across the joint force. This OCS-focused cell also serves as the primary collector and consolidator for major OCS-related information from various sources [...]" which in its totality becomes the OCS COP (Common Operating Picture). The OCSIC ensures relevant OCS COP information flow between the subordinate JFC's primary and special staff members, the designated lead contracting activity, and other key supporting contracting activities such as DLA, the designated military construction agent, Service Civil Augmentation Program (CAP) offices, etc."³⁰

The primary purpose of the OCSIC therefore is to plan, coordinate, and integrate OCS actions across all joint, personal, and special staffs, Service components, Combat Support Agencies (CSAs), and lead theatre support contracting activity in the operational area.³¹ At the Combatant Command (CCMD) level, the OCSIC is a full-time cell, but in operations it will be established by order of the Joint Force Commander (JFC) in a given Area of Operations (AoO). The order will specify from what time and date the OCSIC will become operational, as well as detail OCSIC goals and objectives. A Fragmented Order (FRAGO) describes the OCS requirements for the operation, with the OCSIC synchronizing the OCS efforts in the Area of Operation (AoO).

According to the JP 4-10, "There is no set structure or size for an OCSIC at either level; size and configuration is mission dependent. This cell should be made up of a mixture of specially trained personnel with operational-level logistics and contingency contracting experience. In some operations, this cell could be as small as two individuals, while in other operations it could be significantly larger."³² In addition, the JP 4-10 states "The Services' OCSIC capability varies at CCMD and subordinate joint force levels, but in general, it is very limited. In most component HQs, logistic staff officers perform OCSIC-like functions as an additional/collateral duty when there is no full-time, stand-alone OCSIC. The individual Service component determines the organization and manning of these Service component OCS-focused staffs. They will vary based on specific operational requirements."³³

³⁰ JP 4-10, p. D-1.

³¹ JP 4-10, p. III-7.

³² JP 4-10, p. III-7.

³³ JP 4-10, p. D-2.

Although its size will vary, the OCSIC will handle both requests for logistical support from other nations that can be met by contractors, as well as coordinate multinational OCS assets that may contribute to the overall JF effort. Once it is established, the OCSIC will be incorporated into the JF staff, where it will play an important role as an enabling capability that allows the JFC to deploy the OCS assets in the most successful manner.

f. OCS Working Group

In addition to the OCSIC, US doctrine describes a smaller coordination cell called the OCS Working Group, which "is an as-needed, temporary coordination mechanism utilized by the GCC or subordinate JFC to plan and coordinate OCS matters across the staff and with key mission partners. OCS working groups are normally chaired by a designated OCSIC member and meet as necessary to work specific OCS-related planning or execution-related issues. The OCS working group members vary depending on the issue/action at hand and normally include a mixture of primary and special staff members as well as selected Service component and/or CSA, or other mission partner representatives, as required. Some CCMD level OCS working groups may also include representatives from the Services, JS, and OSD, when required. Unresolved OCS working group issues may be forwarded to the CLPSB if/when it is deemed necessary."³⁴

g. Summary. Risk assessment

The JLSG, NSPA, OCSIC and OCS working groups are examples on how operations on the national and multinational level can be augmented by establishing coordination and integration cells for OCS in order to maximize logistics efficiency and effectiveness. Although the Norwegian Defence may draw upon support from the NATO alliance and other nations in international/multinational operations, most day-to-day operations should be solved with existing national resources. The state framework agreements formalize procedures that enable the Norwegian Defence Forces to draw upon the resources of the civil society to a larger extent than what has previously been done during the past decade.

However, the Norwegian approach as it is currently practiced is not without weaknesses and comes with significant risks, especially in terms of operational security and readiness, command and control, as well as financial considerations. However, the Norwegian experience serves as a potentially very useful case study into the implication of OCS in the future. One challenge is that the intent and content of the major frame agreements are not widely known, even among senior officers. There is therefore a potential for frustration, suspicion and conflict between the military command chain and those operating outside of it, as well as potential bottlenecks in information flow that ultimately can influence the conduct of operations in a negative manner. In addition, the mechanisms for offsetting

³⁴ JP 4-10, p. III-7.

challenges related to C2, readiness and financial issues by integrating civilian actors in the military supply chain has only begun to be addressed in Norway, and especially at the tactical level there is a lack of formalized structures to ensure the successful application of OCS.

THE OCS USE CASE: SUGGESTIONS FOR INNOVATIONS AND IMPROVEMENTS

The target audience for the suggestions for innovations and improvements in this paper is personnel doing logistics assessments before and during operations at both operational and tactical levels. It remains to be seen if the Norwegian model is viable/transferable to other nations, but based on the current trends in military logistics, there is no doubt that the use of OCS will continue to grow in all Western militaries. Our suggestions will therefore be relevant for personnel at the JLSG/ J4-level in their tasks related to activities, both during planning / preparedness and operations:

- At operational level during planning / preparedness our innovations will help the *JFC and planning staffs* to gain from competencies and resources held by civilian actors.
- At operational level during operations, our innovations will help the *Force Commander and the J4* to utilize civilian resources.
- At tactical level during operations, our innovation will help ensuring a Recognised Logistics Picture between *civilian and military actors*, improve interactional competence and information sharing, and hence cater for more flexible cooperation between civilian and military personnel.

Further, our suggestions will have implications for logistics at the strategic level, in terms of demands for joint training, information exchange, and emphasising the importance of interactional competence in contracts with industry. In addition, it is essential to apply a multinational perspective and set up coordinating bodies to help coordinate operations between nations and to avoid duplication of contracted functions.

As mentioned above, the *Joint Concept for Logistics* identifies a "Logistic Gap", exacerbated by what the JCL defines as "Increasingly Demanding Logistics Requirements in an Era of Constrained and Degraded Resources".³⁵ The solution described in the JCL concept of *Globally Integrated Logistics*, defined as "the capability to allocate and adjudicate logistics support on a global scale to optimize effectiveness and responsiveness, and to reconcile competing demands for limited logistics resources based on strategic priorities."

In our view, the following focus areas are crucial to ensure the successful conduct of OCS in operations:

³⁵ JCL, p. 3.

- Transparency (both within Defence, as well as between civilian and military sectors)
- Joint Planning (peacetime, preparedness, ops planning)
- Supply chain wide Information flow (info sharing, defining type of information)
- Command and Control (streamlined inclusion of civilian actors and resources in ops planning)
- The development of Interactional competence (institutionalise training rather than relying on individuals' initiatives)

It is essential that all actors, both civilian and military, to the largest degree possible share the same situational awareness and updated information during operations. It is therefore of the utmost importance that **Transparency** is achieved to a maximum extent. Giving all relevant parties access to "the rules of the game" would help improve trust between actors in and out of uniform. This will also make it easier to share **Information**, as well as involve actors outside of the formal military command chain in the **Planning** process. Ultimately, this will enhance Command and Control, as the relevant Commander achieves a greater level of insight into what capabilities and resources he or she will be able to draw upon in a given situation. In order to establish **Interactional competence** and formalized, **institutionalized structures**, this calls for intensive practice and training.

Based on our reading of the current Norwegian experience, it seems that competence, culture, and procedures to ensure efficient collaboration between military and civilian actors still needs more attention. Continuous organisational change, as found in most organisations, alter the relations and dependencies between the Defence and external actors. Such processes need to be managed wisely to avoid negative impact on the Defence's operational ability. Optimizing the supply chain output presupposes a supply chain orientation; a recognition that processes need to be aligned throughout the whole supply chain.

Weak interfaces between the supplier and the defence could lead to delays in fulfilling requirements, confusion, and increased cost. Findings from literature indicate that relationship development and management in public organisations tends to depend on the initiatives of individuals, without systematic leadership, organisational management support, systems or procedures. The ability to interact needs to be developed both at individual and institutional levels, and may require additional fiscal resources devoted to this specific interaction in recurring non-defence opportunities. Without understanding the mechanisms leading to interactional competence, and without defining indicators to assess interactional processes, success (or lack of success) in the cooperation between the Defence and its civilian partners is difficult to address properly.

From a multinational viewpoint, the JLSG-NSPA and OCSIC constructs are most useful structures that can leverage Operational Contract Support. Used wisely, these institutional constructs allow for better and more efficient use of OCS, by vetting and managing contractors while also integrating the coordination of the OCS effort in the JF staff. Especially in a volatile environment, this will be a vital factor in order to ensure the success of OCS efforts in any given operation. It is paramount that national caveats and different national capabilities and capacities

are identified and managed properly in order to further cooperation, collaboration and coordination. The awareness of OCS must be raised by integrating OCS Subject Matter Experts (SMEs) in J4 staffs and the JLSG.

Both in national and multinational operations, the coordination and cooperation between the tactical command and civilian actors, and the latter’s integration into the Defence structures must be planned for, trained, and practiced. This should be high on the agenda among J4/G4 staff and civilian contractors, so that both military logistics personnel and civilian contractors adopt a mind-set where the civilian actor is not merely a service provider delivering a given product or service, but an active player both before and during operations. As experiences and lessons-learned are collected after exercises, training material will have to be developed in accordance with a DOTmLPF-PII framework.

Hence, the output of our work will be well-tested guidelines, training courses and training material to be applied both at strategic, operational and tactical levels. Their purpose will be to help institutionalising knowledge about civil-military interaction during planning and operation. Training courses and materiel should be made available for personnel both from the civilian actors involved in the defence supply chains, as well as military personnel at operational and tactical levels that will need to collaborate with supplier personnel during planning and operations. The materiel will build on updated research on civil-military interaction, operationalized as the following interactional indicators (see Table 1 below).

Table 1: Interactional Indicators.

<i>The ethical dimension:</i> each participant has equal value and dignity and are willing to take on responsibility in the interaction process	<i>Sense of involvement:</i> be willing, and aware of need to contribute actively, make a personal effort	<i>Coordination of tasks:</i> allocate and transfer tasks; pass them on to the right place / person
<i>Complementary expertise:</i> combining the actors’ unique expertise	<i>Shared situational awareness:</i> through interaction gradually develop shared interpretations.	<i>Role awareness:</i> of each other’s roles, functions, and task allocation
<i>Precise communication:</i> use joint, precise vocabulary	<i>Institutional logic:</i> understand industry terminology, jargons, facts	<i>Balance of power:</i> awareness of power structures
<i>Transparency, confidence, trust:</i> sense of security, mutual trust, make personal contributions	<i>Understanding of organisations and cultures:</i> understand each other’s organisational structures and cultures.	<i>Mastery of tools:</i> systems and routines for efficient interaction
<i>Joint learning:</i> develop common competence	<i>Instinct:</i> understand tacit elements in the interactions	<i>Training in interaction:</i> internalise the principles of collaboration

THE OCS OPERATIONAL CONCEPT

To ensure effective collaboration there must be willingness within the military chain of command to share information and integrate civilian actors in their planning and operations. Moreover, although they operate in a commercial market, the civilian actors must be willing to place the success of military operations as the overarching goal of all their interactions with military actors. This calls for a high level of integration that needs to be trained and practiced on a continual basis.

In terms of DOTmLPPF-II, this will include analyses and revisions of relevant concepts and Doctrines; suggestions for Organisational adjustments to include civilian actors in coordination cells; Training courses and materiel for interactional competence, improved and updated competence for key Personnel, revision of Policies for OCS and/or HNS, as well as efforts to improve Interoperability between civilian and military resources during planning and operations.

Relevant authorities within the defence organization as well as the logistics community must produce easy-to-use information material, as well as prepare educational courses for both the military and civilian side so that this can be practiced and trained. Such training must focus on joint civil-military planning, as well as the challenges of creating a culture of common achievement while addressing issues related to legal, ethical and organizational challenges.

As a starting point, we suggest using a military exercise as an experiment with the following basic tenets:

- Aim: test collaboration and information flows within the whole defence supply chain. Assess how to improve level of interactional competence among civil and military personnel working together during operations.
- Actors involved: JFC, J4, JLSG (/OCSIC), civilian logistics providers/contractors.
- Expected effect: improved Recognised Logistics Picture for all actors involved. More efficient logistics information sharing. JFC/J4 with relevant information to include civilian resources in operational planning.

In the exercise, joint operational logistics should be organised through the JLSG. Organic logistics is sub-ordinated to each relevant Component Command respectively.

To test whether our proposed educational ideas lead to improved interaction between civilian and military personnel, the exercise staff should plan to include the NSPA or another relevant civilian logistics actor as (or augmented to) Theatre Head of Contracts within the JLSG. In addition, the exercise staff should plan to include a civilian coordinator also in a relevant Component Command, tasked to coordinate logistics needs for the Component Command.

Before the exercise start, training will be given both the military and the civilian personnel in the JLSG related to the interactional components. Further, the exercise staff should track relevant information flows from JFC and J4 to the tactical logistics level, focusing on how this information flows to the civilian coordinating

actor. And vice versa, the exercise staff must track how relevant information flows from the civilian actors and to JFC Staff. The objective is to explore if personnel receiving pre-exercise training demonstrate a higher level of interactional competence, make better decisions, and provides better / more timely logistics related information to JFC/J4.

When the exercise is concluded, the findings must be analysed. Based on these conclusions, this paper can then be revised, with the intended End State to provide suggestions regarding enhancement of the overall approach to OCS at both the national, alliance and/or multinational levels for all relevant nations and their military organizations. Building on a thorough reading of doctrines and relevant literature as well as data collected from the proposed exercise, the innovations and improvements suggested in this paper will increase the awareness of OCS capabilities and challenges, and likely highlight the importance of integrating OCS SMEs in J4 staffs and the JLSG.

Although challenges stemming from different business models and other economic issues are highly relevant, the main challenge for implementing OCS more successfully probably lies in the mind-set of existing military organizations as well as their civilian logistics providers. In order to find new ways of tackling future challenges to the military supply chain through the opportunities presented by OCS, military and civilian actors involved in the military supply chain will have to think innovatively. The suggestions presented in this paper should hopefully motivate all relevant logistics personnel to reflect around the complexities and opportunities of this important issue.

Logistikkens nivåer

Remi Jakobsen

INNLEDNING

Hensikten med denne artikkelen er å bidra til å en litt bredere forståelse for militær logistikk med fokus på teaterlogistikk og grenseoppgangen mellom det taktiske og det operasjonelle nivået. Utgangspunktet er en forelesning gjennomført digitalt for masteremnet Operativ logistikk på Forsvarets Høgskole. Artikkelen gir en kort og enkel fremstilling av doktriner, krigføringsnivå og de ulike nivåer ved militær logistikk. Det gjøres også noen vurderinger om grensene mellom taktisk og operasjonelt nivå, som kan være vanskelig å skille. Dette spesielt opp mot en Joint Logistics Support Group som taktisk enhet som et operasjonelt verktøy. Videre gjøres det en kort knytning mot det taktiske og grenvise forhold.

Begrepet logistikk har ulike betydninger. Det blir brukt i mange sammenhenger, i forskjellige kontekster. Det bli bruk i hjemmet, i dagligtalen, i forretningsverden og i militær sammenheng. Utgangspunktet for begrepet og bruken av det er militært. Jomini¹ er en av de første som beskriver begrepet «*Logistikk*». Det betyr en opprinnelse fra en militær kontekst og har sitt fundament i teoretikere som har analysert og sett på Napoleonskrigene². Omfanget har imidlertid lengre og dype historiske røtter innen krigføring, forretning og handel. Det har en bred og ofte litt annen vinkling i militær kontekst enn i sivile. Det å skjønne helheten og kunne se sammenhengen i hva som ligger i begrepet kan være utfordrende. Ofte handler det om ressurser, materiell, service og/eller transport og lagring. Det å ha rett eller fremskaffe tilstrekkelig mengde av, i rett tilstand eller kvalitet, på rett sted og til rett tid er vesentlig i begrepet³. Til slutt handler det om en form for styring for å få dette til⁴. Wikipedia (2020)⁵ sier at logistikk er kunnskapen om å planlegge og organisere vare- og informasjonsstrømmer i næringslivet eller i militæret. Denne begrepsforklaringen er noe mangelfull. I det sivile handler det om optimalisering av økonomiske transaksjoner og om å sette fortjeneste som hovedfokus. Det å skape verdier for en eier som ønsker vekst og profitt er ofte kjernen⁶. En ofte sitert definisjon av forretningsmessig logistikk er hentet fra Council of Supply Chain Management Professionals (CSCMP). Den sier at logistikk er «*kunnskapen om å planlegge, implementere og kontrollere strømmer forover og bakover samt lagre av varer og tjenester med tilhørende informasjon fra opprinnelsessted til forbrukspunkt*⁷». Det handler om å oppnå høyest mulig effektivitet gjennom god service og lave kostnader. I dette ligger det mer helhet.

¹ Jomini, Antoine-Henri. (1836) *"The Art of War"* (translated by G.H. Mendell 1862, originally published in French in 1836, published by Arc Manor: Rockville, USA, 2007).

² Cowen, D. (2014) *"The deadly life of Logistics"* University of Minnesota Press. Minnesota.

³ Bø, Eiril (2018) "Kort om logistikk" Universitetsforlaget, Oslo

⁴ Blanchard, B.S. (2004) *"Logistics Engineering and Management"* Sixth Ed., Pearson Education Inc. Prentice Hall Upper Saddle River, New Jersey

⁵ <https://en.wikipedia.org/wiki/Logistics> (2020)

⁶ Persson, G. og Virum, H. (2011) *"Logistikk og ledelse av forsyningskjeder"* 2. utgave. Gyldendal, Oslo.

⁷ Bø, Eiril (2018) "Kort om logistikk" Universitetsforlaget, Oslo

NATO definisjonen er kanskje den som er mest brukt i dag i den vestlige verden. Den gir en tydelig indikasjon på at det militære innholdet er bredere, omfavner mer og har større kompleksitet enn den sivilt økonomisk orienterte bruken av begrepet.

«Militær logistikk er den virksomheten som planlegger og gjennomfører forflytting, understøttelse og vedlikehold av militære styrker. Det omfatter

- planlegging og utvikling, anskaffelse, lagring, distribusjon, vedlikehold, fordeling og avhending av materiell og forsyninger
- anskaffelse, konstruksjon, vedlikehold, drift og avhending av bygg og anlegg
- anskaffelse eller levering av tjenester inngåelse av kontrakter med leverandører
- sanitets og veterinærtjeneste, herunder evakuering⁸»

I dette ligger noen viktige momenter. Definisjonen favner hele spekteret som ligger i det sivile tankesettet. Fra anskaffelse, i drift og til avhending. Det omfatter også flere ulike nivåer som er knyttet til krigføring; det strategiske, det operasjonelle og det taktiske. Militær logistikk omfavner aktiviteter og ressurser som organiseres og benyttes for å fremskaffe og understøtte militære kapasiteter i forberedelse til - og i operasjoner. Moshe Kress (2002)⁹ definerer det som «en disiplin som omfatter ressursene som trengs for å evne å holde den militær prosess (operasjoner) i gang for å oppnå ønskede resultater (mål)». Det betyr planlegging, styring, bruk av, drift og kontroll av disse ressursene. Definisjonen omfatter hele spekteret som ansees viktig. Det handler om styring og må forstås helhetlig. Det har en viktig kobling og grensesnitt mot samfunnets produksjonskapasitet sett i forhold til militære behov for ressurser (den samlede nasjonale industrielle kapasitet/strategisk base). I tillegg kan en ikke avgrense det til utelukkende militære aktører, aktiviteter og ressurser, men det må forstås i relasjon til forsyningskjeder som inkluderer sivile aktører i både offentlig og privat sektor. Det handler om hvordan militærmaktens rammebetingelser påvirkes av strukturen ved de ulike logistikk-løsningene. Dette betyr at en må forvente at ordninger organisatorisk vil befinne seg utenfor den militære organisasjons hierarkiske kontroll¹⁰. Dette betyr at roller og forutsetninger vil variere. Det handler om militær logistikk i NATO, FN eller andre flernasjonale konstellasjoner samt det en kan kalle totalforsvaret. Understøttelse av militære operasjoner, effektiv oppdragsløsning og ressursstyring knyttet til selve utøvelsen av militærmakt. Dette i spennet fra målrettet og forsvarlig forvaltning, til utnyttelse av samfunnets ressurser i planlegging, gjennomføring, styring og ledelse av forberedelser til- og gjennomføring av militære operasjoner.

⁸ NATO (2019) "AAP-6 NATO Glossary of Terms and Definitions"

⁹ Kress, M. (2002) "Operational Logistics" Springer. Department of operational research. Naval Postgraduate School. Monterey USA

¹⁰ Listou, T. (2020) Innspill til FoU strategi. Forsvarets Høgskole, Sjøkrigsskolen, seksjon for militær logistikk.

KORT OM DOKTRINER

Ordet doktrine betyr læresetning. En doktrine er fastlagte retningslinjer eller praksis innenfor et bestemt område, som gir grunnlag for hvordan noen bør handle eller noe bør være¹¹. Doktriner har til intensjon å skape interoperabilitet eller evne til å operere sammen med like måter å gjøre ting på. Doktrinen er i sin enkleste form en samling fastsatte retningslinjer for militær virksomhet¹². I utgangspunktet vil en i Norge ha to tilnærminger; nasjonal og allianseorientert. Ofte er det nasjonale sterkt orientert mot alliansens doktriner. NATO doktriner er et eksempel på dette. Nasjonalt vil en på det øverste nivået ha politiske styringsdokumenter. Politiske dokumenter som langtidspan (LTP) danner grunnlaget for det øverste militære nivået. Videre vil Forsvarets plan være en operasjonalisering og gjennomføring av dette gjennom den militære organisasjon. Forsvarets fellesoperative doktrine (FFOD) danner grunnlaget for et fellesoperativt tankesettet som hoveddoktrine¹³. Denne gir rammer og grunntanker, og er tett knyttet mot NATO sitt doktrinesett. På logistikkens side har en på strategisk nivå Forsvarsdepartementet (FD) sine retningslinjer for forsvarssektoren¹⁴. Forsvarssjefen har på militær-strategisk side omsatt denne til Direktiv for logistikk¹⁵. Denne underbygges av et konsept som eies av Forsvarets logistikkorganisasjon (FLO) og som gir en overordnet beskrivelse av hva norsk militær logistikk omfatter. Disse er videre utviklet i tett samarbeid med grenene som konsepter.

I NATO har en et hierarki av «policy og MC (Military Committee)» dokumenter som er knyttet til det strategiske nivået. Disse gir den overordnede prinsipielle politiske enighet mellom nasjonene og skaper et utgangspunkt for interoperabilitet. På det operasjonelle nivå utleder AJP-serien (Allied Joint Publications) hvordan eksempelvis logistikk skal gjennomføres. ATP (Allied Tactical Publication), TTP (Tactics, Technics and Procedures), ALP (Allied Logistics Procedures) er knyttet mot taktisk nivå og den praktiske gjennomføringen. På det operasjonelle nivået har doktrinene i NATO en funksjonell inndeling etter standard stabsfunksjonalitet. AJP 01¹⁶ er hoveddoktrinen og beskriver det operasjonelle nivå. AJP-4¹⁷ danner grunnlaget for logistikk og understøttelse. Denne har igjen en serie med funksjonelle doktriner som beskriver særrområder. AJP 4.6¹⁸ JLSG er eksempel på slike.

¹¹ Berli, E.(Red.) (2012) "Innblikk i fellesoperasjoner" FHS Stabsskolens skriftserie. Oslo. Akershus.

¹² Smith, J.D. (2018) "Defence Logistics" Kogan Page. London.

¹³ Forsvarsstaben (2019) "Forsvarets Fellesoperative Doktrine." Forsvaret. Oslo.

¹⁴ Forsvarsdepartementet (2016) "Retningslinjer for logistikk i Forsvarssektoren". Oslo

¹⁵ Forsvaret (2017) "Forsvarssjefens Direktiv for Logistikk" Oslo

¹⁶ NATO (2016) "Allied Joint Publication 1 Allied Joint Doctrine".

¹⁷ NATO (2015) "Allied Joint Publication-4 Logistics"

¹⁸ NATO (2018) "Allied Joint Publication-4.6 JLSG"

ULIKE KRIGFØRINGSNIVÅ

Moderne forståelse av krigføringssområder beskriver normalt tre nivåer. Dette er strategisk, operasjonelt, taktisk nivå. Det strategiske nivået kan sees i to lys. Det ene er det politisk-strategiske nivået – også omtalt som nasjonalstrategisk. Det assosieres med et lands langsiktige og overordnede utenrikspolitiske orientering¹⁹. Dette nivået utformer og angir politiske målsetninger, gir rammer, tildeler ressurser, og samordner sivile og militære virkemidler. Det politiske nivået griper over alle andre nivåer, og tilsvarer kommandomessig en stats regjering eller øverste politiske ledelse. Det andre perspektivet er det militærstrategiske nivået som skaper premissene for relevante kapabiliteter, og gir fagmilitære råd til det politiske nivået. Det foregår samordning av alle militære virkemidler, samt ivaretagelse av samarbeidet med sivile myndigheter og organisasjoner på dette nivået²⁰. I Norge er dette Forsvarsdepartementet (FD) og Forsvarsstaben (FST). Effekter eller målsetninger på det strategiske nivået skal bidra til å svekke en motstanders evne til å gjennomføre krig eller fiendtligheter generelt. Strategiske «effekter» skal søke å nøytralisere en motstander. På dette nivået bestemmes nasjonale eller multinasjonale (allianser eller koalisjoner) sikkerhetsmål og bruk av alle nasjonale ressurser for å oppnå mål og ønskede slutt-tilstander. De strategiske nasjonale målene gir igjen retning for å utvikle overordnede militære mål, som igjen brukes til å utvikle militære mål og strategien for et «teater» eller en operasjon. Strategi er rettet mot resultater eller utfall, der strategiske mål definerer dette nivået²¹. Under noen omstendigheter kan det være riktig å skille mellom et lands strategi som helhet og det som kan betegnes som det "teaterstrategiske" nivået, der en styrkesjef bestemmer og styrer samlede ressurser i større operasjoner innenfor et avgrenset ansvarsområde. Hensikten er å binde disse "teaterstrategiske" målene sammen for å nå overordnet nasjonal strategi og politikk. Generelt tar det strategiske krigføringssnivået opp spørsmål som hvorfor og med hva en skal kjempe og hvorfor fienden kjemper mot oss²².

Operasjonelt nivå utgjør bindeleddet mellom strategisk nivå og det taktiske. På dette nivået blir politiske mål omgjort og operasjonalisert til militært gjennomførbare planer og operasjoner²³. Dette nivået knyttes til avgjørende operasjoner innenfor et større område eller «operasjonsteater», og har til hensikt å styre kompetanse og kapasitet som kreves for å forberede og gjennomføre komplekse operasjoner med to eller flere forsvarsgrener (Hær, Sjø, Luft, Spesialstyrker, Cyber og Logistikk). Nivået i Norge er FOH (Forsvarets fellesoperative hovedkvarter). I NATO har organisasjonsstrukturen Joint Force Command (JFC) denne rollen. Det operasjonelle krigføringssnivået ligger altså mellom det strategiske og taktiske. På dette nivået blir kampanjer og større operasjoner utformet, planlagt, gjennomført,

¹⁹ Berli, E.(Red.) (2012) "Innblick i fellesoperasjoner" FHS Stabsskolens skriftserie. Oslo. Akershus.

²⁰ Forsvarsstaben (2019) "Forsvarets Fellesoperative Doktrine." Forsvaret. Oslo.

²¹ Forsvarsstaben (2019) "Forsvarets Fellesoperative Doktrine." Forsvaret. Oslo.

²² Naveh, S. (2004) "In Pursuit of Military Excellence". Frank Cass. UK.

²³ Naveh, S. (2004) "In Pursuit of Military Excellence". Frank Cass. UK.

understøttet, vurdert og tilpasset for å oppnå de strategiske målsetninger og tilpasset operasjonens behov. Aktivitetene innebærer et større perspektiv knyttet til tid og rom enn på taktisk nivå. De orkestrerer og dirigerer sine taktiske «brikker» (styrker og ressurser) for å vinne striden. Beslutninger på dette planleggingsnivået vil identifisere nødvendige styrker og ressurser og balansere det mot risiko. Operasjoner innebærer integrering av taktiske militære oppdrag og engasjement for å oppnå strategiske mål. Planlegging på det operative krigsnivået avgjør hva vi vil påvirke, med hvilke handlingsforløp, i hvilken rekkefølge, hvor lenge, og med hvilke ressurser.

På det taktiske nivået løses konkrete taktiske oppgaver i tilknytning til de operasjonelle mål. Det assosieres gjerne med slag og trefninger²⁴. Det er på det taktiske nivået den direkte utnyttelsen av stridsmidlene finner sted. Taktisk nivå er knyttet til grenene; Hæren, Sjøforsvaret, Luftforsvaret og FLO med sine taktiske kommandoer. I NATO er taktisk nivå knyttet til de enkelte komponentene (land, luft, sjø, spesialstyrker og funksjonelle områder som Cyber og logistikk). Selv om effektene av disse trefningene kan beskrives som operasjonelle eller strategiske, vil militære handlinger nesten bare være på det taktiske nivået.²⁵ For soldaten er skillet mellom dette nivået og de høyere krigføringsnivåer klart. Soldaten fokuserer i det taktiske nivået på individuelle engasjement, trefninger og oppdrag. Taktiske operasjoner handler om hvordan styrker blir brukt, og detaljene i hvordan trefninger utføres. Taktikk er opptatt av maktens unike bruk, og definerer dette nivået. Kort sagt, det taktiske krigføringsnivået handler om hvordan vi kjemper og hvordan dette gjennomføres²⁶. Logistikeren har ofte en dobbeltfunksjon på dette nivået; både som kriger og logistiker. Jo lengre ut på lavere taktisk nivå en er jo mer praktisk orientert blir logistikksoldaten, men fremdeles med rollen å organisere, håndtere og styre ressurser.

Det er ofte uklare grenser mellom de ulike nivåene. Noen ganger er nivåene tydelige og lett identifiserbare, andre ganger er de tett knyttet og diffuse. Dette gjør i praksis at militære handlinger kan blir knyttet tett opp til politiske beslutninger, noe som gjør at det operasjonelle nivået får en mindre sentral rolle i gjennomføring av enkelte typer operasjoner.

²⁴ NATO (2018) "Allied Joint Publication-3 Doctrine for the conduct of operations"

²⁵ Smith, J.D. (2018) "Defence Logistics" Kogan Page. London.

²⁶ Forsvarsstaben (2019) "Forsvarets Fellesoperative Doktrine." Forsvaret. Oslo.

DE ULIKE LOGISTIKKNIVÅ

Militær logistikk er grovt sagt planlegging, forflytninger og understøttelse (i et vidt perspektiv) av militære styrker. Det er en essensiell del av og viktig komponent for militære operasjoner.

Strategisk logistikk

Strategisk logistikk innebærer utvikling, anskaffelse og klargjøring av militært materiell for å sette opp og bruke styrker - det inkluderer forflytning fra hjemmebaser og mellomliggende baser til ulike teatre²⁷. Det handler om nasjonal industriell base, et sikkert logistikksystem for egne styrker, og kapasitet til å regenerere disse. På det strategiske nivået er logistikk preget av nasjonens industrielle kapasitet, både offentlig og kommersielt for å evne å skape og opprettholde militærmakt og militære operasjoner. Det støtter organisering, trening og utrusning av styrker som er nødvendige for å sikre nasjonens interesser og inkluderer evnen til å forflytte disse (strategisk mobilitet). På dette nivået skal moderne og tydelig definerte, forståtte prosesser kunne drives på tvers av Forsvarssektoren og offentlige etater sammen med nødvendige sivile kapasiteter og organisasjoner. Det er i utgangspunktet FD og FST som planlegger og gjennomfører logistikk på strategisk nivå, hovedsakelig knyttet mot etablering av fasiliteter, anskaffelse, materiell-beredskap og mobilisering. Alt tett knyttet til nasjonens etablerte forsvarspolitik. FLO, forsvarsgrenene, og andre etater som FB (Forsvarsbygg), FMA (Forsvarsmateriell) har også viktige strategiske roller.

Operasjonell logistikk

Operasjonell logistikk består av aktiviteter som kreves for støtte militære styrker knyttet mot kampanjer og større operasjoner i et operasjonsteater²⁸. Et eksempel på sentrale operasjonelle logistiske aktiviteter er styring av deployeringsprosessen. Det vil si mottak, klargjøring og fremføring av personell, utstyr og materiell fra knutepunkter («*point of embarkation og debarkation*») frem til kampsonen, selve understøttelsen og den reverserte deployeringsprosessen når styrker er ferdige med sine oppdrag. Aktiviteter i dette kan være taktiske, men selve styringsfunksjonen og prioriteringene er operasjonelle. Ser en på forsvarsgrenene vil hærstyrker oftest ha et stort avtrykk i disse prosessene. Luftforsvaret er i hovedsak knyttet til faste eller midlertidige baser (flyplasser – Deployed Operation Bases - DOB), mens maritime enheter, som har stor iboende mobilitet og egenkapasitet, er mindre avhengig av deployeringsprosessene. Både maritime enheter og luftstyrker trenger logistikk med høy responsevne for å gi støtte der de er i teateret. Operasjonell logistikk er

²⁷ Smith, J.D. (2018) "Defence Logistics" Kogan Page. London.

²⁸ Kress, M. (2002) "Operational Logistics" Springer. Department of operational research. Naval Postgraduate School. Monterey USA.

kunsten å anvende de militære ressursene en har tilgjengelig for å nå nasjonale militære mål i et teater eller operasjonsområde, eller for å lette gjennomføringen av tildelte oppdrag i en militær region, teater eller kampanje²⁹. Operasjonell logistikk blir i Norge utviklet, planlagt, koordinert og utført av FOH i tett samarbeid med FLO ved Nasjonal logistikkoperasjonssenter (NLOGS) som utførende (taktisk) ledd. I NATO vil dette være knyttet til JFC sin stabs- og fagfunksjon innen logistikk (J4) med taktisk utførelse av en Joint Logistics Support Group (JLSG), som gjør dette og er det operasjonelle verktøyet.

Logistikk på taktisk nivå

Logistikk på taktisk nivå omfatter planlegging, koordinering og utførelse av de i hovedsak funksjonelle områdene for logistikk³⁰; forsyning, vedlikehold, transport, sanitet, ingeniørtjenester og logistiktjenester/-service. Taktisk logistikk må være synkronisert med den styrke de støtter og fokusere på tre viktige egenskaper ved taktisk krigføring; beskyttelse, mobilitet og ildkraft. På dette nivået er krigføring konkret, fokusert og med begrensinger knyttet til ildkraft, tid og rom³¹. Logistikk her er spesifikt og tilpasset de gitte omgivelser. Funksjonene, kombinert med de mekanistiske og kvantifiserbare egenskapene, gjør at taktisk logistikk kan betraktes som en "vitenskapelig aktivitet". Det handler om kalkulasjoner (i en eller annen form), planlegging og grunnleggende ledelse samtidig som en må være soldat for å overleve i et stridsfelt. Alle militære enheter av en viss størrelse har en organisk logistikk-kapasitet. Logistikk på taktisk nivå med en viss kapasitet utføres i utgangspunktet av styrkesjefene (komponenter). Dette er i Norge knyttet til den enkelte forsvarsgren, FLO og Cyberforsvaret. I NATO vil det være AC (Air Command), MC (Maritime Command) og LC (Land Command) nivået med sine styrker som har denne rollen. Taktisk logistikk innebærer utførelse av logistikk i og i umiddelbar nærhet av striden (kamplogistikk) og understøttelsesfunksjoner med ressurser som er tilgjengelig i eller ved styrkene. Logistikeren vil her se og være del av kamphandlinger og må kunne opptre som soldat og våpenbærer. Logistikk på taktisk nivå er avhengig av kapasiteter i teateret samt forhold identifisert gjennom planlegging og koordinering på operasjonelt nivå, deriblant identifisering av taktiske behov. Å utnytte forsterkende taktisk eller teaterlogistikk gjør at de stridende enheter kan utnytte sine logistiske kapasiteter på riktig måte og evne å opprettholde den operative effektivitet over tid.

²⁹ NATO (2015) "Allied Joint Publication-4 Logistics".

³⁰ US Department of Defence (2019) "Joint Publication 4-0 Joint Logistics"

³¹ Smith, J.D. (2018) "Defence Logistics" Kogan Page. London.

MILITÆR LOGISTIKK I GRENSESKILLET MELLOM TAKTISK OG OPERASJONELT NIVÅ

Det operasjonelle nivået knyttet til krigføring utkjempes først og fremst i et teater der styrkesjefer bruker sine styrker for å lede kampanjer eller større operasjoner for å nå strategiske målsettinger³².

Militær styrker er ikke det eneste maktinstrumentet operasjonelt nivå benytter³³. De samhandler også med sivile institusjoner, har politikk og diplomati i fokus samt økonomi og psykologi som virkemidler. Helheten i dette krever oppmerksomhet og forståelse. Det operasjonelle krigføringsnivået ville vært lettere å mestre hvis aktivitetene ble styrt utelukkende av vitenskapelige prinsipper eller lover. Dessverre er aktivitetene preget av en høy grad av vold, usikkerhet, risiko, friksjon og begrensede ressurser³⁴. Nettopp styring og orkestrering av ressurser preger det operasjonelle nivå, og ofte er mye relatert til logistikk og ressursstyring.

En sjef på operasjonelt nivå ser utforming og gjennomføring av kampanjer eller større operasjoner mer som en kunstform og mindre som vitenskap. Det å mestre denne kunstformen betyr i utgangspunktet å besvare fire grunnleggende spørsmål. Det første er «hvilke militære forhold vil gi ønsket slutt-tilstand?» Det andre er «hvilke handlinger og rekkefølge på disse er nødvendig for å oppnå de rette forhold?». Det tredje er «hva er den mest effektive måten å bruke tilgjengelige ressurser på for å oppnå den handlingssekvensen?». Det siste spørsmålet vil være «hvilke risikoer og kostnader knyttes til dette settet med handlinger?»³⁵. Ressursperspektivet ansees svært viktig på det operasjonelle nivået. Etablering av et felles teaterlogistikksystem handler om kommunikasjonslinjer, installasjoner, militære logistiske enheter (kapasiteter) og støtte fra en eventuell vertsnasjon. Operasjonell logistikk-kapasitet skal sikre tilstrekkelige ressurser for å understøtte alle faser i en kampanje. Som disiplin, skal det løse spenningen mellom de konkurrerende logistiske prinsipper for å skape effektivitet – (indre effektivitet (efficiency) og ytre effektivitet (effectiveness)). Strategisk logistikk handler om å utnytte fordelene ved standardisering, ensartethet, forutsigbarhet og stordriftsfordel, mens taktisk logistikk skal sikre fleksibilitet og responsevne gjennom enkelhet og overlevelsessevne. Å bygge bro over gapet mellom disse to effektivitetsbegrepene – «efficiency» av strategisk logistikk og «effectiveness» av taktisk logistikk er den store utfordringen i den operasjonelle logistikk-kunsten. Balansering av behov nå og forbruk sett i forhold til behov for å bygge opp logistikk-kapasitet for påfølgende kampanjefaser eller operasjoner, sikring av kommunikasjonslinjer, og logistisk evne til å understøtte samt opprettholdelse av tempoet i operasjonen er noen av de mer utfordrende oppgaver for logistikk på det operasjonelt nivå. Organisering,

³² NATO (2016) "Allied Joint Publication 1 Allied Joint Doctrine".

³³ Høybakk, H. og Ydstebø, P. (2012) «Krigens vitenskap - innføring i militærteori» Abstrakt forlag, Oslo

³⁴ Berli, E.(Red.) (2012) "Innblikk i fellesoperasjoner" FHS Stabsskolens skriftserie. Oslo. Akershus.

³⁵ Berli, E.(Red.) (2012) "Innblikk i fellesoperasjoner" FHS Stabsskolens skriftserie. Oslo. Akershus.

prioritering og fordeling av ressurser i en kampanje for å oppnå et teaterstrategisk mål er kanskje det vanskeligste aspektet ved den operasjonelle kunst. Selv om grunnleggende beslutninger rundt personell, utstyr og materiell som ble gjort før kampanjen følger planen, vil sjefen måtte oppdatere og endre seg og sine planer kontinuerlig i takt med at operasjonen utvikler seg. Det å gjøre ressursprioritering og tildelinger utgjør et av teatersjefens viktigste ansvarsområder. Hensikten med beslutningene er å skape helhetlig kampkraft. Sjefen må derfor planlegge hvordan begrensede teaterressurser kan brukes mest mulig hensiktsmessig. Integrering og synkronisering av styrker i et fellesoperativt perspektiv vil kunne fremme ønskede synergieffekter. Dette kan gjøre det mulig å kontrollere timing og tempoet i en kampanje. Under planlegging og gjennomføring må en forene tidsfaset bruk av ressurser med det som skjer av hendelser underveis. Fasing på det operasjonelle nivå er en svært viktig aktivitet. En stor del av sjefens ressursprioriteringer og beslutninger er i stor grad knyttet til logistikkaktiviteter. «Joint» (felles) operasjonell logistikk er i Norge FOH sitt ansvar. I utgangspunktet har ikke Norge det en kan kalle for komplette «komponenter» (sett i forhold til styrkenes størrelse), men har et hovedkvarter som kan styre styrkebidrag fra grenene fellesoperativt. I NATO gjør JFC dette. Her prioriteres bruk av logistiske ressurser for å generere, produsere og støtte i hele teateret. FOH bruker NLOGS som verktøy for å sikre effektivitet og økonomi i gjennomføringen. Et viktig aspekt er å unngå unødvendig duplisering av fasiliteter og overlapping av funksjoner ute hos gren- eller komponentsjefene. Selv om grensjefer er ansvarlige for egen logistiske støtte, kan det operasjonelle nivå prioritere at visse logistiktjenester skal brukes av hele styrken fra en spesifikk gren (omprioritering). I NATO er det JFC som har dette ansvaret. Til dette vil J4 som fagstab drive planlegging og utviklingen etter føringer fra sjefen. Her vil en utvikle de logistiske elementene i en operasjonsplan samt identifisere behov for logistisk understøttelse. Etablering av logistikk styringssystem, eller kommando og kontrollsystem (K2), gjøres i planleggingen av en operasjon, og gjennom styrkegenereringsprosesser³⁶. Under planlegging, koordinering og gjennomføring på det operasjonelle nivå kan sjef JFC etablere en JLSG og styre omfang og struktur av denne. Det vil si at JFC J4 planlegger, prioriterer og koordinerer logistisk støtte, styrer logistiske muligheter og risikoer samt bygger et logistikkilde «*recognised logistics picture*» (RLP). J4 gir råd til sjef JFC om logistiske behov og hva som kreves for å utføre oppdraget. Rollen til stabselementene i J4 er å koordinere og lede funksjonelle områder ved å utarbeide logistiske planer (lang/mellomlang sikt), og ved å tilby kontinuerlig vurderinger, råd, anbefalinger og detaljplanlegging (kort sikt) for å støtte virksomhet i operasjonsområdet (Joint Operations Area – JOA).

³⁶ NATO (2016) "Allied Joint Publication 1 Allied Joint Doctrine".

JOINT LOGISTICS SUPPORT GROUP: TAKTISK RESSURS, OPERASJONELT VERKTØY.

En JLSG er en fellesoperativ, deployerbar militær enhet med kapasitet til å levere logistikk og sy sammen den logistiske helheten for en fellesoperativ sjef. Det betyr at den blir betraktet tilsvarende som en komponent, og opererer på taktisk nivå. Likevel er den tett knyttet mot fagstaben hos JFC – J4. Når deployert, vil den drive utførende logistikkledelse og sikre understøttelse av de øvrige komponentene. Den har kommando over COM JTFs felles logistikkenheter og skal skape synergier. Dette betyr at enheten ligger i grenseskillet mellom det operasjonelle og taktisk nivå. En JLSG skal sørge for egenunderstøttelse av logistikk på første- og andrelinje enten organisk eller gjennom knytninger til andre komponenter. En søker å samhandle med komponenter om felles-tjenester og støtte for å møte behov ved bruk av de styrker en har tildelt, vertslandsstøtte og/eller kontraktører. Hensikten er å utnytte stordriftsfordeler og å evne å opprettholde effektiv og helhetlig logistikk. Dette vil muliggjøre bedre samarbeid, forbedret og optimalisert fotavtrykket i operasjonen og redusere kostnader. Sjef JLSG er ansvarlig overfor COM JTF for koordinering og utførelse av logistisk støtte ved bruk av tildelte nasjonale, vertsland og/eller kommersielle ressurser. COM JLSG³⁷ skal:

- koordinere og synkronisere aktivitetene i det fellesoperative logistikk-nettverket og utøve myndighet over enheter som går inn/ut av operasjonsområde (JOA) som en del av RSOM/RMSD-prosessene
- bidra til RLP (logistikk bildebygging)
- rådggi COM JTF samt vurdere operasjonelle logistiske risiki
- koordinere bruken av NSE-kapasiteter til å støtte JTF
- styre og rapportere logistiske kapasiteter underlagt JLSG
- bidra i utvikling og koordinering av HNS
- støtte COM JTF under planleggingsprosessen
- etablere krav til movement og transportation (M&T) og initiere, koordinere og de-konflikte forflytninger på operasjonelt nivå i samsvar med COM JTF
- støtte COM-utførelsen av RSOM / RMSD
- sikre operasjonell understøttelseevne (sustainment)»

Operasjonelle hensyn og operasjonstypen vil ha betydelig innvirkning på logistikk-konseptet og den spesifikke ledelses- og styringsstrukturen som blir implementert. Et logistikk-konsept må tilpasses type eller særegenhet i operasjon og operasjonsområde. Logistiske operasjoner på dette nivå er avhengig av å benytte nasjonale, HN og kommersielle kapasiteter og multinasjonale logistikkressurser og kunne sikre optimal ressursbruk. Bruken av multinasjonal logistikk er et middel, avhengig av de krav og den spesifikke situasjonen en er i. Ved dette kan en styrke logistisk effektivitet. Alle nasjoner som bidrar i en slik styrke bør vurdere om multi-

³⁷ NATO (2018) "Allied Joint Publication-4.6 JLSG"

nasjonale ordninger kan gi fordeler eller om de vil være i konflikt med nasjonale interesser. Fordelene og begrensningene ved den multinasjonale tilnærmingen ved logistikken må derfor tydelig kommuniseres. Dette omfatter felles ressursbase, redusert deployeringsbehov, utnyttelse av nasjonale nisjer og spesialistkapasiteter, optimering av logistisk fotavtrykk, økt interoperabilitet, redusert konkurranse om ressurser og ikke minst reduserte kostnader. Uavhengig av type eller omfang av operasjon vil tidlig aktivering og oppsett av JLSG kunne være en effektiv multiplikator ved å legge til rette for tidlige, effektive og multinasjonale løsninger.

KNYTNINGER MOT DET TAKTISKE NIVÅ OG GRENVISE BEHOV

Siden NATOs operasjonelle logistikktilnærming er nært knyttet til det multinasjonale vil hver komponent, på grunn av arten av sine oppdrag, ha en litt annen tilnærming til implementering av multinasjonale logistiske alternativer. Støtteelementer må være fleksible, mobile og responsive i forhold til kravene til den enkelte komponenten.

Det maritime domene

Støtte til en deployert multinasjonal maritim styrke har to elementer; landbasert støtte og sjøgående støtte. Den sjøgående støtten er normalt koordinert og styrt som en taktisk eller organisk ressurs hos sjøkomponenten. Landstøtte omfatter nødvendig logistisk virksomhet for å understøtte den maritime styrken. I utgangspunktet gjøres dette gjennom en eller flere fremskutte logistikkstøttepunkter (FLS – Forward Logistics Sites), avhengig av operasjonsområdet og styrkens størrelse. Hovedprinsippet for det maritime logistiske landstøttekonseptet er å være et siste omlastningspunkt for personell, post og last (PMC – Personnel, Mail and Cargo) når sjøgående enheter, samt for å være en nødvendig vedlikeholdsinfrastruktur i en fremskutt base. For å sikre fokus, må landstøtteorganisasjonen være tilpasset den enkelte styrkes behov og størrelse. Informasjon om logistikkstøtte til maritime komponenter er beskrevet i ALP-4.1 Multinational Maritime Force Logistics³⁸. Maritime enheter preges av at de har høy mobilitet og evne til å forflytte seg raskt over store områder. Plattformene har høy evne til å understøtte seg selv over tid. I tillegg vil en ofte ha en organisk struktur i form av dedikerte logistikkfartøy. En maritim styrke vil normalt planlegge å etterforsyne seg selv i omlag 30 dager. Det som er utfordrende ved maritim logistikk er kritiske reservedeler som må flyttes mot styrken. Av klasseforsyninger er det i utgangspunktet klasse III (drivstoff og oljer) og klasse V (ammunisjon) som er drivende for operasjonene. Teknisk logistikk og vedlikehold er også viktig for maritime enheter.

³⁸ NATO (2016) «Allied Logistics publication 4.1 Maritime Logistics»

Landdomenet

Støtte til deployering av multinasjonal landstyrke krever en klar forståelse blant bidragsytere om at nasjonal logistikk er del av et multinasjonalt rammeverk til støtte for helhetlig drift. Multinasjonal logistisk støtte til en landstyrke på den moderne slagmarken krever fleksibilitet og mobilitet over hele spekteret. Landskomponentens støttekonseptet er designet for å sikre nødvendig understøttelse til både nasjonale og multinasjonale styrker. Det skal ta hensyn til forskjellige nasjonale styrkestrukturer. Logistikken er basert på nasjonale bestemmelser og den multinasjonale støtten som blir avtalt mellom bidragsytende nasjoner. Detaljer om landkomponentlogistikk finnes i ALP-4.2³⁹, Land Forces Logistics Doctrine.

Landoperasjoner er i utgangspunktet avhengig av en type infrastruktur for å forflytte stryker frem til kampsonen. Normalt sett vil styrkene ikke kunne flytte seg selv fra hjemmebase til operasjonsteater. RSOM prosessen er svært viktig for en landenheter og er vesentlig mer avhengig av logistikk og infrastruktur enn det en maritim styrke er. Mobilitet og evne til å løfte seg selv over større avstander er en av utfordringene til landenheter. I forhold til logistikk og volum vil klassene I, III og V være drivende. Det vil kreve store ressurser å holde flyt av disse forsyningene fremover i et operasjonsområde. Kompleksiteten i forsyningslinjene til en landoperasjon er også relativ stor. Landkomponenten er kanskje den komponent som er mest avhengig av en JLSG struktur.

Luftdomenet

Luftlogistisk støtte skal tilfredsstillende behovet for hurtighet og må være effektiv under alle forhold. Våpensystemene som brukes av luftstyrker er teknisk sammensatte, og legger større belastninger på landbasert håndtering og service/ reparasjonsfasiliteter. I tillegg må en kunne tilpasse seg til operasjoner utenfor egne faste baser. Dette kan være svært krevende, spesielt dersom en må sette opp en struktur på «bare base». Luftlogistikk er støttet av en rekke prinsipper for å opprettholde tempoet i luftoperasjoner. Beskrivelse av luftkomponentens logistikk finner en i ALP-4.3⁴⁰, Air Forces Logistics Doctrine and Procedures. Luftenheter er avhengig av en viss form for basestruktur. Det mest krevende ved luftlogistikk er den tekniske understøttelse som moderne luftstyrker krever. Vedlikehold av fly og helikopter krever kompetanse og fasiliteter i høyere grad enn land og sjøenheter. I forhold til volum er det spesielt klasse III og V som er utfordrende for luftenheter.

³⁹ NATO (2010) «Allied Logistics publication 4.2 Land Logistics»

⁴⁰ NATO (2002) «Allied Logistics publication 4.3 Air Logistics».

Spesialoperasjonsdomenet

På grunn av omfanget, tempoet og oppdragenes art opprettholdes understøttelsen generelt gjennom separate nettverk. Spesialstyrkene er imidlertid blitt stadig mer avhengig av logistisk støtte fra konvensjonelle krefter. Følgelig bør JFC planlegge å bidra til understøttelse av spesialstyrker og lette understøttelsen. Spesialstyrkers logistikk er beskrevet i AJP -3.5⁴¹, Fellesoperativ doktrine for Spesialoperasjoner.

OPPSUMMERT

Logistikk påvirker alle aspekter ved militære operasjoner. I stor grad dikterer logistikk hva som er gjennomførbart eller ikke, og ofte er dette underkommunisert. Militære planer utarbeidet i isolasjon fra logistiske planer vil føre til store utfordringer og i beste fall betyr at man påtar seg langt større risiko enn hva som kan være akseptabelt. Logistikk må likevel ikke bare sees på som utgangspunkt for begrensninger. I stedet er det en funksjonell kapasitet som må analyseres, vurderes og utnyttes på best mulig måte. Riktig planlagt og tett integrert i operativ planlegging og gjennomføring av operasjoner, fremmer logistikk fokus, mulighet og fleksibilitet. Operativ logistikk handler på alle nivå om riktig ressursforvaltning.

⁴¹ NATO (2013) «*Allied Joint Publication 3-5 Special Operations*».

2.

VITENSKAPELIGE
ARTIKLER

Fagfelleurdert til nivå 1

Fagfelleurdert artikkel

Evaluering av Forsvarets logistikkssystem – utvikling og anvendelse av et nytt metodisk rammeverk

Gunn Alice Birkemo¹, Ola Krogh Halvorsen¹ og Emil Graarud¹

Sammendrag

Tidligere studier ved Forsvarets forskningsinstitutt har påpekt gap i Forsvarets logistikkssystem. Hensikten med denne studien har vært å undersøke om Forsvarets logistikkssystem, ved bruk av strategiske partnere, påvirker Forsvarets reaksjonsevne, utholdenhet og robusthet, samtidig som det oppfyller krav til kostnadseffektivitet. Studien ble gjennomført ved å utvikle et metodisk rammeverk som deretter ble anvendt. Rammeverket omfatter åtte egenskaper ved logistikksystemet som indirekte gjør det mulig å vurdere i hvilken grad logistikksystemet bidrar til å dekke krav til operative leveranser. Rammeverket ble anvendt på vertslandsstøtten som ble gitt av Forsvarets logistikkssystem i løpet av den fire måneder lange Trident Juncture 2018. Med unik tilgang på primær- og sekundærdata, ble empiri samlet inn gjennom semi-strukturerte intervjuer, dokumentgjennomgang og observasjoner. Studien viser at Forsvaret ved å bruke ressursene til strategiske partnere sikret seg skalerbar tilgang på logistikkressurser – materiell, personell og tjenester – på områder som ikke er en del av Forsvarets kjerneoppgaver. Logistikk-systemet legger også til rette for kostnadseffektivitet. Evalueringen av Forsvarets logistikk-system viser imidlertid at ressursutnyttelsen kan bli bedre, noe som vil forbedre reaksjonstid og utholdenhet i logistikksystemet. Artikkelen presenterer et nyutviklet rammeverk som gjør det mulig å vurdere logistikksystemets bidrag til operativ evne, selv med empiri fra en fredstidsøvelse. Med en unik tilgang på primær- og sekundærkilder, bidrar artikkelen til å belyse bruk av strategiske partnere i et militært logistikkssystem på en problemstilling som tidligere har vært lite studert.

Nøkkelord: strategisk partnerskap, operativ logistikk, vertslandsstøtte, Trident Juncture, sivilmilitært samarbeid

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INNLEDNING

En militær styrkes operative tilgjengelighet og utholdenhet avhenger av logistikkunderstøttelse. I løpet av det siste tiåret har den sikkerhetspolitiske situasjonen blitt stadig mer krevende og kompleks, og varslingstiden har potensielt blitt svært lav, noe som stiller strenge krav både til militær logistikkunderstøttelse og evne til å håndtere allierte mottak. Et logistikksystem som skal understøtte en norsk militær styrke må ha (Forsvarsdepartementet, 2016):

1. Kapasitet til å håndtere et alliert mottak samtidig med Forsvarets styrkeoppbygging
2. Evne til logistikkunderstøttelse av operasjoner i hele landet
3. Reaksjonsevne i tråd med styrkenes klartider
4. Evne til understøttelse i hele operasjonens varighet
5. Evne til å levere logistikk i daglige operasjoner, krise, konflikt og krig

Det er samtidig en forutsetning at disse fem operative kravene skal dekkes med et logistikksystem man har råd til å drifte i fredstid. Tidligere FFI-studier har påpekt gap i Forsvarets logistikksystem (Forsvarets forskningsinstitutt, 2017). For å utvikle et logistikksystem som oppfyller krav til reaksjonsevne, utholdenhet og robusthet, samtidig som det oppfyller krav til kostnadseffektivitet, har Forsvaret endret innretningen av logistikksystemet. Dette har ført til en kraftig omstilling i forsvarssektoren, og økt konsentrasjon om Forsvarets kjernevirksomhet. Forsvarets logistikkorganisasjon (FLO) har fått ansvar for å utvikle kostnadseffektiv logistikkunderstøttelse ved å videreutvikle «[...] logistikkonsepter som fullt ut utnytter kapasiteten som finnes hos det sivile næringslivet» (Forsvarsdepartementet, 2016a).

For å komplementere Forsvarets egne ressurser, har FLO det siste tiåret inngått strategiske partnerskap med flere private aktører, som leverer deler av logistikken i Forsvaret samt vertslandsstøtte i forbindelse med alliert mottak. Dette er i tråd med trendene i kommersielle verdikjeder, med outsourcing og bruk av tredjepartsleverandører for levering av tjenester og funksjoner som virksomhetene tradisjonelt har utført selv, men som gjerne ligger utenfor deres kjernekompetanse (Akbari & Hopkins, 2016; Bueno, 1997; Christopher, 2011; Miah et al., 2013). Ved å sette ut øvrige oppgaver til eksterne leverandører med spisskompetanse og kapasitet, kan oppgavene utføres billigere, bedre eller begge deler (Christopher, 2011; Porter, 1997). Flere aktører i forsyningskjeden fører imidlertid til økt kompleksitet, noe som gir økt risiko for tap av kontroll over egen forsyningskjede. Dette kan motvirkes ved å inngå tettere og mer langsiktige samarbeid og partnerskap med de viktigste leverandørene. Ifølge Christopher & Lee (2004) er bedrifter og virksomheter villige til å gå bort fra kortsiktige, transaksjonsbaserte forretningsrelasjoner til fordel for strategiske partnerskap. Flere studier dokumenterer de potensielle gevinstene man kan oppnå ved å bygge disse tette kommersielle relasjonene (Liker & Choi, 2004; Stank et al., 2001).

Vertslandsstøtte (Host nation support, HNS) danner et grunnlag for rask alliert forsterkning og bidrar til å opprettholde de allierte styrkenes stridsevne under en operasjon. Støtten omfatter mange sivile og militære aktører, og leveranser av varer og tjenester, som forsyning, vedlikehold, sanitets- og veterinærtjenester, forlegning,

transport, styrkemottak og styrkebeskyttelse (Birkemo, Graarud & Halvorsen, 2019). Høsten 2018 var Norge vertsland for Nato-øvelsen Trident Juncture 2018 (TRJE18). Dette var den største militære øvelsen som har vært gjennomført i Norge siden den kalde krigen, med mer enn 50 000 øvelsesdeltakere fra 31 land, 12 000 kjøretøy og rundt 250 fly og helikopter (Forsvarets logistikkorganisasjon, 2019). Øvelsen gav en unik mulighet for å evaluere den nye innretningen til Forsvarets logistikksystem, med omfattende bruk av strategiske partnere.

Erfaringene fra TRJE18 er brukt for å evaluere logistikksystemets evne til å 1) gjennomføre vertslandsstøtte og 2) dekke de fem overordnede operative kravene. Det var ikke mulig å teste samtlige av de fem operative kravene direkte, blant annet fordi god tid til planlegging gjør at ikke alle kravene blir utfordret i tilstrekkelig grad under en øvelse i forhold til en reell krise eller krig. Det er altså faktorer som ikke kan evalueres direkte med de begrensningene i empiri en fredstidsøvelse innebærer. Evnen til å dekke de fem operative kravene påvirkes imidlertid av en rekke egenskaper ved logistikksystemet. For å evaluere det nye logistikksystemets evne til å dekke de operative kravene, og vertslandsstøtten spesielt, er det utviklet et metodisk rammeverk basert på *egenskaper* ved logistikksystemet, som deretter er benyttet for å evaluere dette systemet.

FORSVARETS NYE LOGISTIKKSYSTEM

Overordnede krav til logistikksystemet

Logistikksystemet må kunne møte både operative og forvaltningsmessige krav. Hva innebærer så de operative kravene? Det første kravet – *Kapasitet til å håndtere et alliert mottak samtidig med Forsvarets egen styrkeoppbygging* – er utfordrende med hensyn til samtidighetsbehovet for logistisk understøttelse. Støtte fra Nato er avgjørende for Norges evne til å håndtere de mest krevende scenarioene som Norge kan bli utsatt for, Artikkel V i Nato-traktaten, som er en sentral forutsetning for norsk forsvarspolitik. I Nato-operasjoner er alle avsenderlandene i utgangspunktet ansvarlig for å understøtte egne styrker logistisk samt ansvarlig for å dekke egne kostnader (Nato, 2013). Ved å være i stand til å tilby effektiv vertslandsstøtten kan Norge senke terskelen for alliert støtte hvis det skulle bli behov (Skjelland et al., 2019). Vertslandsstøtte kan være vesentlig mer krevende – både i volum og kompleksitet – enn logistikkstøtte til nasjonal styrkeoppbygging og nasjonale operasjoner. Kravet til vertslandsstøtte kan dermed bidra til å dimensjonere logistikksystemet med hensyn til infrastruktur, materiell, personell/tjenester og forsyningsberedskap. Det er tre mulige løsninger for å sikre tilstrekkelig kapasitet, nemlig å ha all kapasitet tilgjengelig internt i Forsvaret, å sikre tilgang på all kapasitet utenfor egen organisasjon gjennom avtaler eller å velge en kombinasjon av de to første løsningene.

Det andre kravet – *Evne til logistikkunderstøttelse av operasjoner i hele landet* – innebærer at nødvendige ressurser må være tilgjengelig i alle deler av Norge. Hovedvekten av den sivile kapasiteten på logistikkressurser som Forsvaret har behov for er i Midt- og Sør-Norge (Birkemo, Graarud & Halvorsen, 2019). De to nordligste fylkene har en betraktelig lavere andel av ressursene enn den sørligste delen av landet. Logistikksystemet må derfor finne løsninger som tar hensyn til geografiske variasjoner i ressurstilgjengeligheten.

Det tredje kravet – *Reaksjonsevne som er i tråd med styrkenes klartider* – innebærer at ressursene må være tilgjengelig på svært kort tid. Reduserte klartider gjør at det er behov for større materiell-tilgjengelighet enn tidligere. Logistikk-systemet må for eksempel ha løsninger som sørger for at en tilstrekkelig andel av materiellet er vedlikeholdt og klart til bruk, og at lagernivåene er tilstrekkelig store. Logistikk-systemet må samtidig sikre rask tilgang på personell med riktig kompetanse slik at logistikk-tjenester kan gjennomføres når behovet oppstår. Behovet for forsyningsberedskap må også dekkes.

Det fjerde kravet – *Evne til understøttelse i hele operasjonens varighet* – innebærer at logistikk-systemet bidrar til Forsvarets utholdenhet. Logistikk-systemet må derfor ha løsninger for å dekke et kapasitetsbehov i en definert periode. Dette innebærer blant annet at Forsvaret etter en innledende fase i operasjonen får etterforsyninger og at materiell blir vedlikeholdt, slik at til-gjengeligheten opprettholdes gjennom hele operasjonen.

Det siste kravet som logistikk-systemet må kunne møte er *Evne til å levere logistikk i daglige operasjoner, krise, konflikt og krig*. Dette forutsetter et logistikk-system som er skalerbart, fleksibelt og kostnadseffektivt, men samtidig tilstrekkelig forutsigbart for de militære enhetene som skal understøttes. For å oppnå effektive logistikkleveranser i hele krisespekteret, må løsningene bidra til at understøttelsen gjennomføres så likt som mulig i ulike deler av krisespekteret (gitt juridiske begrensninger) (Forsvarssjefen (FSJ), 2017), og at logistikk-systemet øver i henhold til prinsippet «train as you fight» (US Marine Corps, 2016).

Utover disse overordnede kravene, gir flere styrende dokumenter fra perioden 2012–2017 føringer for videreutviklingen av Forsvarets logistikk-system (Forsvarsdepartementet, 2012a; Justisdepartementet, 2016; Forsvarsdepartementet, 2016). Det er spesielt tre føringer som har hatt betydning for utviklingen av Forsvarets nye logistikk-system: enklere styringslinjer, kostnadseffektive driftsmodeller og økt sivil-militært samarbeid.

Utviklingen av Forsvarets nye logistikk-system

For å oppnå forenklede styringslinjer er det opprettet en ny styringsstruktur for logistikken. Internt i FLO skjedde dette i første rekke ved å etablere en permanent kadre for et felles taktisk ledelselement for logistikk-, sanitets- og vertslandsstøtte i Norge (Forsvarsdepartementet, 2012a; Forsvarsdepartementet, 2012b), Nasjonal logistikkkommando (NLK). Forsvarets kompetansesenter for logistikk og operativ støtte (FKL) ble også overført fra Hæren til FLO (Forsvarsdepartementet (2016a)). Til sammen gav dette mulighet for sentralisert styring av alle logistikkressurser.² NLK, som i 2017 endret navn til Nasjonalt logistikkoperasjonssenter (NLOGS), har kun militært ansatte. Militær logistikkledelse på taktisk nivå gir mulighet for å ivareta en enhetlig logistikkledelse i alle faser av en operasjon uavhengig av om

² Kommandomessig styrer FOH gjennom NLOGS, som igjen er ansvarlige for å styre alle logistikkoperasjoner. Det er NLOGS som gir oppdrag til Forsvarets logistikkstyrker og til sivile samarbeidspartnere.

ressursene stammer fra forsvarssektoren eller sivile leverandører. Dette er særlig viktig i et sivil-militært grensesnitt hvor sivile leverandører direkte understøtter Forsvarets operasjoner. Militær ledelse av alle operasjoner gjør at prinsippet om militær kommando og kontroll ivaretatt, og at man ved å benytte kjente og øvde militære kommandolinjer i krise og krig får den ønskede effekten. For å ivareta behovet for hurtige avgjørelser i situasjoner som krever høy reaksjonsevne, er NLOGS innrettet som et døgnkontinuerlig logistikkoperasjonssenter. Flere styrende dokumenter er også utviklet de senere år for å avklare roller, ansvar og myndighet innen militær logistikk (Forsvarssjefen, 2017 a–c).

Forsvaret er avhengig av å bruke sivil kapasitet for å løse de mest krevende situasjonene (Reitan, 2018; Heireng & Birkemo, 2016; Skjelland et al., 2019). FLO har økt samarbeid med sivile ved å inngå strategiske avtaler. Avtalene er utelukkende inngått med logistikkelskaper med solid norsk eierskap, som er villige til å inngå et langsiktig partnerskap med Forsvaret. De strategiske avtalene har klausuler med beredskapskrav til tid og volum, og selskapene forplikter seg også til å levere i en krigssituasjon (Dahl, 2016), noe som manglet i de fleste tidligere avtalene (Birkemo & Kuran, 2015). Det er inngått rundt 15 strategiske avtaler per 2020, som gir tilgang på infrastruktur (baser og havner), transport (land, luft og sjø), vedlikehold og ulike forsyningsklasser. De strategiske avtalene gir tilgang til et bredt spekter av ressurser og et nettverk av underleverandører og personellressurser som kan integreres i Forsvarets struktur ved behov. Målet har i første omgang vært å tette gap i den eksisterende støttestrukturen, og deretter å øke kapasiteten innenfor de områdene som var viktigst basert på en operativ vurdering, for å oppnå redundans i logistikk-systemet. Avtalene erstatter ikke eksisterende militær kapasitet, men utgjør en tilleggskapasitet. Ifølge FLO har Forsvaret, gjennom de strategiske avtalene, eksempelvis økt tilgangen på logistikkpersonell med inntil ti ganger (Forsvarets logistikkorganisasjon, 2018a). For å sikre at det sivil-militære samarbeidet fungerer best mulig, gjennomføres felles planlegging mellom sivile og militære om bruk av ressursene. Det er opprettet koordineringsceller der personell fra to av de største strategiske partnerne, WilNor Governmental Services (WGS) og Grieg Strategic Services (GSS), er samlokalisert med NLOGS. Sivilt personell fra strategiske partnere tar del i plan-leggingen av den operative logistikken. Dette gir mulighet for at Forsvaret ivaretar den nødvendige militærfaglige virksomhetsforståelsen og samtidig får tilgang på den sivile markedskunnskapen, og at strategiske partnere får bedre militær situasjonsforståelse. Det å trekke sivile leverandører så tett inn på den militære organisasjonen er imidlertid ikke vanlig i Nato-sammenheng.

For å oppnå kostnadseffektive driftsmodeller følger den nye logistikk-løsningen i størst mulig grad prinsippet om å ha en høy andel variable kostnader og en lavere andel faste kostnader. Ved å bruke strategiske avtaler får Forsvaret tilgang til logistikkressurser uten å måtte finansiere faste kostnader som følger med denne kapasiteten, for eksempel kostnader til personell eller drift. Det kan likevel bli høyere midlertidige kostnader når ressurser fra strategiske partnere er i bruk.

METODE

Datainnsamling

For å få en mest mulig helhetlig forståelse for hvilke krav som stilles til Forsvarets logistikkssystem og for logistikksystemets ytelse, er det samlet inn data fra en ulike typer kilder. Det har blitt gjennomført en omfattende dokument- og litteraturgjennomgang (Bowen, 2009), semi-strukturerte intervjuer (Bryman, 2004), observasjon på orienterings- og planleggingsmøter, både under og etter TRJE18, samt gjennomgang av Host Ordering and Billing System (HOBS, bestillings- og faktureringsverktøyet benyttet under TRJE18) og digitale samarbeidsplattformer.

Dokumentanalysen bestod i å systematisk gjennomgå og evaluere ulike dokumenter. I denne studien er styrende dokumenter utgitt av Forsvaret, Forsvarsdepartementet og Nato gjennomgått for å identifisere de mest sentrale kravene til militære logistikk-systemer. Planer, ordrer og bestemmelser som ble skrevet i forbindelse med TRJE18 ble gjennomgått for å undersøke om kravene til logistikk-systemet ble ivaretatt og om logistikk-systemet innehar nødvendige egenskaper. Ved å gjennomgå den akademiske litteraturen identifiserte vi ytterligere egenskaper som var særlig relevante for å evaluere logistikk-systemet.

Semi-strukturerte intervjuer ble gjennomført ved å sende forhåndsutviklede intervjuguider som var utgangspunkt intervjuene til intervjuobjektene (heretter kalt informanter). Det ble gjennomført 26 intervjuer med en varighet på 60–90 minutter. Det var to til tre forskere (forfatterne) med på hvert intervju, og det ble ikke gjort lydopptak underveis. Først ble det gjennomført intervjuer med personell fra ledelsen i FLO, ledelsen i NLOGS, ulike fagseksjoner i NLOGS, Transportoperasjonssenteret (i FLO), SOR-organisasjonen og regional logistikkledelse i ulike regioner. Deretter ble personell fra Forsvarets operative hovedkvarter, Heimevernet, Forsvarsbygg, Nato, US Marine Corps (USMC) og utvalgte strategiske partnere (WGS, GSS og Bertel O. Steen) intervjuet. Vertslandsstøtteseksjonen i NLOGS var en løpende sparringspartner og kom med innspill i kvalitetssikringsprosessen.

Forfatterne var bisittere på totalt 19 planleggings- og orienteringsmøter med blant annet Natos Joint Logistics Support Group (JLSG), FOH og NLOGS, der formålet var å observere dialogen og samhandlingen mellom relevante aktører i operasjonen. Vi fikk også tilgang til ulike samhandlingsverktøy, som SharePoint på FisBasis Begrenset, og brukerrettighet i HOBS som gav kvantitativ empiri på omfang avbestillinger, vertslandsstøttebehov og leveranser til deltakerlandene.

Utvikling av rammeverk

Gjennomgangen av styrende dokumenter identifiserte en rekke egenskaper som et logistikk-system som skal understøtte militære operasjoner må ha. Disse egenskapene, omtalt som prinsipper i dokumentene, er listet opp i tabell 1. Den akademiske litteraturen innen forsyningskjeder og militær logistikk beskriver også en rekke egenskaper forsyningskjeder må ha, egenskaper som er delvis overlappende med prinsippene for et militært logistikk-system. Definisjonene av en og samme egenskap varierer imidlertid i ulike vitenskapelige artikler, noe som blant annet diskuteres av Gligor, Holcomb og Stank (2013) og Sharma et al. (2017).

Rammeverket er utviklet i den hensikt at det også skal kunne brukes uten at man har dyp kunnskap om relevant akademisk litteratur. Det har derfor vært et mål å bruke mest mulig gjenkjennbare akademiske uttrykk for de ulike egenskapene som utgjør rammeverket. Disse egenskapene kan imidlertid være delvis overlappende med andre egenskaper som diskuteres i den akademiske litteraturen.

Tabell 1: Prinsipper for logistikk og vertslandstøtte som er brukt som grunnlag for hvilke egenskaper som ble inkludert i rammeverket for evaluering av Forsvarets logistikksystem (Nato, 2014; Nato, 2013; Nato, 2003; Forsvaret, 2014; Sjef FLO, 2013; FSJ, 2004)

Dokument	Prinsipper
Nato Principles and policies for logistics	<i>Logistics principles:</i> Coordination and cooperation, assured provision, sufficiency, efficiency, simplicity, flexibility, visibility
Allied joint Logistic doctrine	<i>Logistics principles:</i> Primacy of operations, responsibility, authority, cooperation, coordination, provision and sufficiency, flexibility, simplicity, timeliness, economy, transparency and visibility, synergy
Allied joint doctrine for host nation support	<i>Host Nation Support principles:</i> Responsibility, provision, authority, cooperation, coordination, economy, visibility, reimbursement
Forsvarets fellesoperative doktrine	<i>Prinsipper for fellesoperasjoner:</i> Enhetlig kommando/ innsats, utholdenhet, kraftsamling, fleksibilitet, operasjonssikkerhet, enkelhet, gjennomsliktighet
Konsept for logistikk i Forsvaret	<i>Logistikkprinsipper:</i> Økonomisering, helhet, enkelhet, fleksibilitet, reaksjonsevne, utholdenhet, samarbeid
Logistikk- og støttekonsept for Forsvaret	<i>Prinsipper for transformering av logistikk- og støttevirksomheten:</i> Helhetlige fellesløsninger, integrasjon, enkelhet, fokus, fleksibilitet, økonomisering, synlighet.

Tradisjonelt fremheves kostnadseffektiv (*efficient*) og operativt effektiv (*effective*) som viktige egenskaper for å få en responsiv forsyningskjede, slik at tids- og mengdegap minimeres i forsyningskjeden (Kress, 2002; Reichhart & Holweg, 2007; Lee, 2002). I likhet med prinsippene i de styrende dokumentene, fremheves egenskapen fleksibilitet av mange i den akademiske litteraturen (Tang, 2006; Reichhart & Holweg, 2007). Fleksibilitet nevnes også ofte som en viktig side ved egenskapen smidighet (*agility*), som de siste 20 årene har fått stadig økende oppmerksomhet innen forskning på forsyningskjeder (McNaugher, Johnson & Sollinger, 2000; Sharma et al., 2017). Andre faktorer som er avgjørende for forsyningskjedens ytelse, er god informasjonsdeling og tilgang på digitale verktøy for å understøtte informasjonsdelingen (Gunasekaran et al., 2008; Caridi et al., 2014; Wu, Iyer & Preckel, 2015).

En gjennomgang av den akademiske litteraturen viste at det ikke eksisterer et rammeverk som passer til en evaluering av vertslandsstøtte eller et logistikksystems evne til å oppfylle operative krav i en militær operasjon. Et rammeverk av Pettit, Fiksel og Croxton (2010) som er utviklet for å evaluere robustheten til en forsyningskjede er likevel relevant for vår studie. Basert på en rekke sårbarhetsfaktorer identifiserer de følgende 14 ulike egenskaper som en forsyningskjede bør inneha for å være robust: fleksibel ressurstilgang, fleksibilitet i leveransmåte, kapasitet, effektivitet, synlighet, tilpasningsevne, evne til å forvente og anslå behov, gjenopprettelse, distribusjon, samarbeid, organisering, markedsposisjon, sikkerhet og finansiell styrke. Skoglund (2012) har forsket på hvordan fremskaffelsesbeslutninger³ påvirker ulike egenskaper ved den militære logistikken i det svenske forsvarets under en fredsbevarende operasjon. Flere av problemstillingene Skoglund presenterer er relevante når man diskuterer løsningene i det norske forsvaret. Skoglund understreker at fremskaffelsesbeslutninger, med tilhørende logistikk-løsning, forutsetter at forsyningskjeden har to viktige egenskaper; fleksibilitet som bidrar til å håndtere etterspørselsendringer og smidighet som bidrar til å redusere risiko for flaskehals.

Vi har utviklet et rammeverk for å evaluere egenskaper ved Forsvarets nye logistikksystem. Prinsippene i tabell 1 er egenskaper ved Forsvarets logistikksystem som påvirker den operative ytelsen til logistikksystemet. Disse ses opp mot egenskaper som den akademiske litteraturen behandler og logistikksystemets krav til operative leveranser under TRJE18. Det er flere forhold som har påvirket hvilke egenskaper som er inkludert i rammeverket. Både generelle egenskaper ved logistikksystemet og egenskaper som påvirkes av endringene som er gjort i Forsvarets logistikk er inkludert. Videre har tilgang til empiri påvirket valg av egenskaper, ettersom det er lite hensiktsmessig å inkludere operative egenskaper som ikke lar seg måle basert på en øvelse. Eksempelvis er viktige egenskaper som reaksjonsevne og evnen til styrkebeskyttelse i liten grad evaluert. Flere av egenskapene vil indirekte påvirke reaksjonsevnen, noe som blir poengtert der det er relevant.

Basert på gjennomgangen av styrende dokumenter og akademisk litteratur identifiserte vi åtte egenskaper som var målbare og som gjør det mulig å evaluere i hvilken grad den nye innretningen til Forsvarets logistikksystem dekker de fem operative kravene. De åtte egenskapene er: kapasitet, kostnadseffektivitet, enkelhet, integrasjon, synlighet, fleksibilitet, rettidighet og kompetanse. Disse er definert i tabell 2. Sammenhengen mellom egenskapene og operative krav til logistikksystemet er illustrert i tabell 3. Evalueringen presenteres i tabell 4.

Kapasitet er en kvantitativ betegnelse på tilgang til ressurser. Å sikre tilgang til tilstrekkelig mengde logistikkressurser til rett tid på riktig sted bidrar til å opprettholde stridsevnen, og er derfor logistikkens viktigste oppgave på taktisk nivå (Kress, 2002; Forsvarsdepartementet, 2016b). Dette omfatter både materiell, forsyninger og vedlikehold. Tilstrekkelig kapasitet er en avgjørende forutsetning for en effektiv logistikk og bidrar til både utholdenhet og reaksjonsevne. Egenskapen kapasitet påvirker dermed alle de fem operative kravene direkte (tabell 3).

Kostnadseffektive logistikk-løsninger er et krav som er satt til FLO som fagmyndighet logistikk (FSJ, 2017b). Forsvaret er avhengig av et logistikksystem det

³ *Beslutninger for å fremskaffe riktig utsyr, leveranser og tjenester til riktig sted og riktig tid.*

Tabell 2: Tabellen viser egenskapene samt en kort definisjon av egenskapene, som er inkludert i rammeverket.

Egenskap	Definisjon
Kapasitet	Tilgang på tilstrekkelig mengde ressurser
Kostnadseffektivitet	Logistikk med rett kvalitet til lavest mulig kostnad
Enkelhet	Enkel, enhetlig og tydelig gjennomføring i alle situasjoner
Integrasjon	Grad av samvirke mellom sivile og militære enheter
Synlighet	Logistisk situasjonsforståelse
Flexibilitet	Logistikksystemets tilpasningsevne
Rettidighet	Rettidig etablering av den operative logistikkstrukturen
Kompetanse	Tilgang på nødvendig kompetanse

har råd til å drifte i fredstid og som samtidig er i stand til å levere i en omfattende krise-/krigssituasjon der omfanget av styrker som skal understøttes vil mangedobles ved en alliert operasjon i Norge. Ved å ousource en del oppgaver vil andelen av variable kostnader øke, mens andel faste kostnader vil reduseres, noe som kan bidra til en kostnadseffektiv løsning (Kremic et al., 2006; Kakabadse & Kakabadse, 2002; Abraham & Taylor, 1996). Kress (2002) definerer kostnadseffektivitet som forholdet mellom forventet operativ effekt og ressursinnsatsen (kostnadene relatert til logistikken). Egenskapen kostnadseffektivitet påvirker indirekte alle de fem operative kravene som er satt til logistikksystemet.

Enkelhet innebærer at logistikken styres, planlegges og gjennomføres likt i hele krisespekteret, og blant annet følger «train as you fight»-prinsippet (US Marine Corps, 2016). Videre inkluderer denne egenskapen tydelighet i planer og ordre, slik at risiko for misforståelser minimeres. En forutsetning for høy grad av enkelhet er tydelighet i roller, ansvar og myndighet samt at kommando og kontroll gjennomføres i tråd med styrende dokumenter og eventuelt forhåndsplanlagte prosedyrer. Enkelhet er avgjørende for å minimere tid brukt til koordinering og kommunikasjon og bidrar dermed til økt effektivitet og ressursutnyttelse. Enkelhet er en egenskap som direkte påvirker logistikksystemets reaksjonsevne og ressurstilgjengelighet (Reichhart & Holweg, 2007). Egenskapen enkelhet påvirker dermed fire av de fem operative kravene direkte.

Integrasjon sier noe om i hvilken grad involverte aktører samvirker, og i hvilken grad sivile kommersielle partnere er integrert i det militære logistikksystemet. Integrasjon bidrar til felles situasjonsforståelse og godt samarbeid og er en forutsetning for ytelsen til strategiske partnere. Dette reduserer risiko for misforståelser og bidrar til at riktig leveranser kommer til riktig sted på riktig tid, noe som blant annet bidrar til økt reaksjonsevne og mer effektiv ressursbruk (Reichhart

& Holweg, 2007; Kwon & Suh, 2004; Skoglund, 2012). Egenskapen integrasjon påvirker dermed operativt krav 3 og 5 direkte mens krav 1, 2 og 4 blir påvirket indirekte, som illustrert i tabell 3.

Synlighet innebærer at aktører i forsyningskjeden får tilstrekkelig forståelse for ressursituasjonen ved tidsriktig, korrekt og relevant informasjonsdeling om

Tabell 3: Tabellen viser de sammenhengene vi mener er mest avgjørende for de operative kravene til logistikksystemet. X viser direkte sammenhenger, mens (X) er indirekte sammenhenger. Egenskapene ved Forsvarets logistikkssystem vil i ulik grad, direkte eller indirekte, påvirke operative krav som settes til logistikksystemet. De operative kravene oppsummeres i følgende fem punkter: Evne til å håndtere et alliert mottak samtidig med Forsvarets styrkeoppbygging (krav 1); Evne til logistikkunderstøttelse av operasjoner i hele landet (krav 2); Reaksjonsevne i tråd med styrkenes klartider (krav 3); Evne til understøttelse i hele operasjonens varighet (krav 4); Evne til å levere forsterkende logistikk i daglige operasjoner, krise, konflikt og krig (krav 5).

Egenskap	Krav				
	1	2	3	4	5
Kapasitet	X	X	X	X	X
Kostnadseffektivitet	(X)	(X)	(X)	(X)	(X)
Enkelhet	X	X	X		X
Integrasjon	(X)	(X)	X	(X)	X
Synlighet	X	(X)	X	(X)	X
Fleksibilitet	X	X	X	(X)	X
Rettidighet	(X)	(X)	X		(X)
Kompetanse	X	(X)	(X)	(X)	X

tilgang til – og behov for – ulike logistikkressurser. Denne informasjonsdelingen til sivile og militære aktører på ulike nivåer er viktig for å oppnå en best mulig ressursprioritering og dermed effektiv styring av logistikken (Caridi et al., 2014; FLO, 2013; Forsvaret, 2014; Nato, 2013; Pettit et al., 2010). Synlighet er en egenskap som bidrar til samtlige operative krav til logistikksystemet, og dermed til den operative effekten og kostnadseffektiviteten i en logistikkoperasjon (Nato, 2014). Synlighet bidrar i tillegg til økt kontroll, økt tempo i logistikkflyten og økt fleksibilitet i logistikkoperasjoner (Pettit et al., 2012; Nato, 2013).

Reichhart & Holweg (2007) definerer fleksibilitet som den evnen forsyningskjeden har til å tilpasse seg og respondere på intern eller ekstern påvirkning, for å oppnå et ønsket resultat. Logistikkprosesser og -organisasjoner bør derfor innrettes slik at den enkelt kan tilpasses og anvendes i ulike situasjoner (FSJ, 2004;

Christopher & Towill, 2002). Å trene på å operere sammen med støttet styrke under varierende forhold kan eksempelvis bidra til å øke fleksibiliteten til Forsvarets logistikksystem (FLO, 2013). Basert på innsamlet empiri, er vår vurdering av fleksibilitet bidrar direkte til fire av de fem kravene og indirekte til ett krav som stilles til logistikksystemet, som vist i tabell 3. At fleksibilitet er blant de viktigste faktorene i en forsyningskjede støttes også av litteraturen (Reichhart & Holweg, 2007; McNaugher, Johnson & Sollinger, 2000; Sharma et al., 2017).

Egenskapen rettidighet sier noe om i hvilken grad ulike enheter i logistikksystemet ble etablert tilstrekkelig tidlig under TRJE18. Tilstrekkelig tidlig etablering er nødvendig for å ha god situasjonsforståelse, god styring av logistikken og effektivitet i logistikkoperasjonen (FSJ, 2017b). Med begrensede ressurser vil det imidlertid ikke være god ressursutnyttelse å etablere deler av logistikksystemet for tidlig. Rettidighet er inkludert i rammeverket ettersom flere militære enheter i logistikksystemet, som NLOGS og Vertslandsstøttebataljonen, bygges opp fra en kadrestruktur. Flere faktorer vil bidra til en rettidig etablering av enheter i logistikksystemet, eksempelvis god situasjonsforståelse, tilstrekkelig tilgang til egnet personell når det blir nødvendig og evne til å gjennomføre beslutninger raskt. Egenskapen rettidighet påvirker dermed operativt krav 3 direkte mens krav 1, 2 og 5 blir påvirket indirekte, som vist i tabell 3.

Egenskapen kompetanse sier noe om de samlede kunnskaper, ferdigheter, evner og holdninger som gjør det mulig å utføre oppgavene i tråd med definerte krav og mål (Lai, 2013). I vår kontekst betyr dette hvorvidt Forsvarets logistikksystem innehar tilstrekkelig og korrekt kompetanse til å gjennomføre de ulike oppgavene i tråd med de operative kravene som stilles (FSJ, 2017b). Ved å evaluere dette vil studien samtidig kunne benyttes til å videreutvikle ramme-betingelser som ivaretar helhetlig kompetansestyring for logistikk i Forsvaret, et ansvar FLO er tildelt (FSJ, 2017b). Egenskapen kompetanse påvirker dermed alle de operative kravene indirekte.

Evaluering av hver enkelt egenskap er kontekstavhengig. Kostnadseffektivitet er en konkret føring gitt fra politisk hold og er spesielt viktig i fremtid, mens de andre egenskapene er viktig i hele krisespekteret for å oppnå høy operativ effekt. De ulike egenskapene påvirker måloppnåelsen i de operative kravene som satt til logistikksystemet direkte eller indirekte. Ved å velge egenskaper som påvirker de operative kravene kan vi undersøke om logistikksystemet bidrar til den overordnede måloppnåelsen. I tabell 3 vises vår vurdering av hvilke egenskaper som påvirker de ulike operative kravene til logistikksystemet og om egenskapen har en direkte eller indirekte effekt på kravene. Hver enkelt egenskap blir evaluert basert på data innhentet i forbindelse med TRJE18. For å evaluere egenskapene ble det benyttet en femtrinns fargeskala (grønn som betyr meget bra, lysegrønn som betyr bra, gul betyr noen mangler men uten operative konsekvenser, oransje som betyr mangler med noen operative konsekvenser eller rød som betyr mangler med alvorlige operative konsekvenser).

EVALUERING AV EGENSKAPENE VED FORSVARETS LOGISTIKKSYSTEM

For å evaluere hvordan økt bruk av strategiske partnere påvirker logistikk-systemets operative leveranser ble åtte egenskaper ved logistikksystemet analysert basert på erfaringene fra TRJE18. Egenskapene som ble evaluert var *kapasitet, kostnadseffektivitet, enkelhet, integrasjon, synlighet, fleksibilitet, rettidighet og kompetanse*. Det er i tillegg til tekst benyttet en trafikklysvurdering der grønn betyr meget bra (tilstrekkelig), lysegrønn betyr bra (stort sett tilstrekkelig), gul betyr noen mangler uten operative konsekvenser, oransje betyr betydelige mangler med noen operative konsekvenser og rød betyr betydelige mangler med alvorlige operative konsekvenser. Evalueringen er oppsummert i tabell 4.

Tabell 4: Overordnet evaluering av logistikksystemets evne til å gjennomføre vertslandsstøtte i forbindelse med TRJE18. Ingen av de manglene som ble identifisert fikk operative konsekvenser. Vurderingskriterier: grønn = meget bra (tilstrekkelig), lysegrønn = bra (stort sett tilstrekkelig), gul = noen mangler uten operative konsekvenser, oransje = betydelige mangler med noen operative konsekvenser og rød = betydelige mangler med alvorlige operative konsekvenser.

Egenskap	Definisjon	Evaluering
Kapasitet	Sikre tilgang på tilstrekkelig ressurser	Grønn
Kostnads-effektivitet	Levere etterspurt ytelse med lavest mulig ressursinnsats	Grønn
Enkelhet	Enkel, enhetlig, tydelig og lik gjennomføring i alle situasjoner	Gul
Integrasjon	Logistikkstøtte med militære og sivile virksomheter i en integrert prosess	Lysegrønn
Synlighet	Logistisk situasjonsforståelse	Gul
Fleksibilitet	Logistikksystemets tilpasningsevne	Grønn
Rettidig	Rettidig og planmessig etablering av organisasjonen	Gul
Kompetanse	Tilgjengeligheten på nødvendig kompetanse	Lysegrønn

Kapasitet – Ressurstilgang

Kapasiteten til et logistikksystem omfatter tilgangen på alt personell, materiell og tjenester som inngår i en HNS-operasjon. Denne evalueringen er avgrenset til HNS-kapasitet knyttet til Forsvarets logistikksystem.

Ved bruk av strategiske partnere har Forsvarets logistikksystem økt tilgjengelig kapasitet betraktelig. Dette er en sentral forutsetning for en effektiv logistikk

(Kress, 2002; Forsvarsdepartementet, 2016b). Under TRJE18 viste strategiske partnere evne til å fremskaffe nødvendige logistikkressurser til Forsvaret og besøkende styrker. Erfaringene fra øvelsen viser også at de strategiske avtalene med sivile logistikkelskaper gir Forsvaret en ressursbrønn som de selv ikke har. I tillegg utgjør strategiske avtaler en skalerbar og fleksibel kapasitet for ressurstyper Forsvaret besitter, men hvor de vil få en stor økning i behov ved et alliert mottak.

Den overordnede vurderingen av kapasiteten til Forsvarets logistikkssystem er at økt bruk av strategiske partnere ga Forsvaret tilstrekkelig kapasitet til å gjennomføre øvelsen på en god måte. Ingen store kapasitetsgap ble avdekket og konklusjonen var at alle fikk alt de trengte. Basert på erfaringene i TRJE18 er dermed ikke kapasitet noen begrensende faktor for tilgang på ulike typer ressurser. Egenskapen *kapasitet* vurderes derfor til grunn, svært god.

Kostnadseffektivitet – Etterspurt ytelse med lavest ressursinnsats

Som en offentlig etat plikter Forsvaret å bruke felleskapets begrensede ressurser mest mulig *kostnadseffektivt*.

Ved å bruke strategiske partnere som kapasitetsbrønn praktiserer Forsvaret prinsippet om lav andel faste kostnader og høy andel variable kostnader. Dette gjør at man unngår å finansiere en omfattende understøttelsesstruktur som sjelden tas i bruk i sin helhet. Med kraftige variasjon i behovet for logistikkjenester vil bruk av sivile leverandører være kostnadsbesparende i de fleste tilfeller (Abraham & Taylor, 1996). Deler av de varer og tjenester som Forsvarets logistikkssystem skal bidra med er så å si identisk med sivile løsninger, for eksempel transport og kantinetjenester. Potensielt kan man oppnå kostnadsbesparelser ved inngå beredskapsavtaler med ulike strategiske partnere fremfor å eie all den tid man ikke gjennomfører store operasjoner (Reitan, 2018). Erfaringene fra TRJE18 kan ses på som en aktivitetstopp, og empirien var derfor ikke egnet til å kunne evaluere de kostnadsreducerende effektene av lavere faste kostnader. De variable kostnadene ble derimot nøye dokumentert gjennom øvelsen. Tidlige og tydelige frister for bestilling av logistikkjenester, sentralisert styring av logistikken samt FLOs mulighet til å kontrollere kostnadseffektiviteten i logistikk-løsninger som levert av strategiske partnere gjorde det i stort mulig å identifisere de variable kostnadene.

Sentralisert styring av logistikken er en annen endring i logistikk-systemet som kan gi utslag på kostnadseffektiviteten ettersom det potensielt gir bedre ressursoversikt med mulighet for optimal ressursprioritering og ressursutnyttelse. Erfaringer fra øvelse TRJE18 viser at Forsvaret og strategiske partnere i hovedsak benyttet nasjonale logistikkressurser under øvelsen. I tråd med Natos doktrine for vertslandsstøtte (2013) ble all militær forlegning i operasjonsområdet nyttiggjort for man bestilte forlegningskapasitet fra strategiske partnere. Tilgjengelige allierte ressurser ble ikke nyttiggjort i tilsvarende grad. Flere informanter trekker frem at deltakerland hadde transportressurser som forble ubrukte mens SOR-organisasjonen bestilte transport fra strategiske partnere.

Under øvelsen fikk strategiske partnere et fast påslag for alle innkjøp, slik at deres totale inntekter økte med omfang og pris på bestillinger. De strategiske partnerne hadde dermed ingen direkte finansielle insentiver til å til å finne de mest kostnadseffektive løsningene. Både FLO og strategiske partnere understreker

imidlertid at insentivene for å opprettholde et langsiktig samarbeid overgår insentiver for eventuelle kortsiktige gevinster.

Empiri fra TRJE18 er ikke tilstrekkelig til å vurdere om Forsvaret klarer å ta ut kostnadsbesparelsene man ifølge litteraturen kan oppnå gjennom en redusert fast kostnadsbase (Abraham & Taylor, 1996). Bruken av strategiske partnere gjorde imidlertid at Forsvaret fikk dratt nytte av produktivitetsvekst og kompetanse hos de strategiske partnerne som ligger utenfor Forsvarets kjernekompetanse. Generelt gjør en god utnyttelse av nasjonale logistikkressurser, solid kostnadskontroll og hensiktsmessig bruk av strategiske partnere at FFIs vurderer kostnadseffektiviteten i logistikksystemet til å være svært god, grønn.

Enkelhet – Enhetlig og tydelig gjennomføring i alle situasjoner

Egenskapen *enkelhet* betegner en enkel, enhetlig og tydelig styring og gjennomføring av logistikken i hele krisespekteret og uavhengig av geografi. Dette er en egenskap som ofte nevnes i militære styrende dokumenter.

Ved å sammenlikne erfaringene fra TRJE18 med styrende dokumenter, ordrer og erfaringer fra tidligere øvelser, finner vi at gjennomføringen i stor grad samsvarte med dokumentene når det gjelder roller, ansvar og myndighet (RAM) og kommando og kontroll (K2). Sentral ledelse av logistikken er et godt utgangspunkt for å oppnå enkelhet ved at det gir mulighet for enhetlig styring og ledelse. Informanter fra både strategiske partnere og FLO oppfattet at rolle- og oppgaveforståelsen i stort var avklart mellom strategiske partnere og den sentrale organisasjonen i NLOGS. RAM knyttet til bruk av strategiske partnere var imidlertid ikke beskrevet i norske eller allierte styrende dokumenter. Enkelte informanter mente at grensesnittet mellom strategiske partnere og militære enheter med liknende oppgaver var uklart. Dette førte til at behov for koordinering og kommunikasjon ble uforholdsmessig stort, og at enkelte oppgaver ble utført forskjellig av ulike aktører. Det var også enkelte avvik fra kommandoforholdene som var bestemt for ulike militære enheter i forbindelse med TRJE18, noe som bidro til lavere grad av enkelhet. Strategiske partnere var ansvarlig for kontakt mot underleverandører, slik at FLO kun hadde behov for å koordinere mot noen få strategiske partnere istedenfor et sett av underleverandører. For FLOs ledelse og styring av logistikken bidro dette til økt grad av enkelhet. Den utstrakte bruken av strategiske partnere førte imidlertid til et økt behov for å tydeliggjøre kontaktpunkt og grensesnitt mellom avdelinger på ulike nivåer i Forsvaret og strategiske partnere, noe som bidro til lavere grad av enkelhet.

Innretningen gjør at logistikksystemet potensielt kan oppnå en høy grad av enkelhet dersom man eksempelvis presiserer rollen til de strategiske partnere i styrende dokumenter. Logistikksystemet har imidlertid noe forbedringspotensial knyttet til klargjøring av RAM og K2 innen vertslandsstøtte og synliggjøring av strategiske partnere i forbindelse med utvikling av styrende dokumenter. Basert på erfaringene fra TRJE18 er egenskapen enkelhet derfor vurdert til gul.

Integrasjon – Grad av samvirke mellom sivile og militære enheter

Et grep som har blitt gjort for å sikre *integrasjonen* av strategiske partnere har vært opprettelsen av koordineringsceller hvor strategiske partnere sitter samlokalisert med NLOGS.

Under øvelse TRJE18 var samtlige informanter fra NLOGS og strategiske partnere enig i at koordineringscellene bidro til god samhandling og felles situasjonsforståelse på styringsnivå. Ved å være med på logistikkplanleggingen under øvelsen fikk strategiske partnere økt forståelse for Forsvarets logistikkbehov, slik at strategiske partnere og underleverandører kunne tilpasse understøttelsen ytterligere og bedre samkjøre leveranser gjennom hele forsyningskjeden. Høy grad av integrasjon bidro til at man bedre fikk koblet sivile ressurser mot militære behov til riktig tid og sted. Dette er momenter som er viktig for å oppnå effektiv logistikk og i tråd med den eksisterende akademiske litteraturen (Reichhart & Holweg, 2007; Kwon & Suh, 2004; Skoglund, 2012). Til tross for tett integrasjon under TRJE18 var det enkelte utfordringer med informasjonsflyten til strategiske partnere, samt deres forståelse av militære behov. Informasjon om krav til logistikkløsninger fra ulike fagmyndigheter i Forsvaret ble ikke tilstrekkelig kommunisert eller forstått. Eksempelvis var kravsettingen til kjøkken i de midlertidige leirene forstått ulikt hos Forsvaret og strategiske partnere, noe som førte til forsinkelser og ekstra kostnader.

Den overordnede vurderingen av egenskapen *integrasjon* er at de etablerte koordineringsceller bidrar til økt informasjonsflyt, bedre ressursoversikt og en mer omforent situasjonsforståelse. Dette er faktorer som bidrar til et effektivt logistikksystem. Basert på erfaringene fra TRJE18 vurderes egenskapen integrasjon til lysegrønn.

Synlighet – Logistisk situasjonsforståelse

Med Forsvarets økte bruk av sivile logistikkleverandører og strategiske partnere er det ekstra viktig å oppnå en felles logistisk situasjonsforståelse, *synlighet* (Caridi et al., 2014; Yu et al., 2001).

For å oppnå synlighet ble det før TRJE18 utviklet et eget ugradert bestillingsverktøy for varer og tjenester, Host nation Ordering and Billing System (HOBS). Dette ble brukt av både leverandører, FLO og deltakernasjonene. Dette gav god oversikt over logistikkbehovene (hvem, hva, hvor, når) og status på leveransene, i tillegg til at man i HOBS lagde bindende avtaler. Samtlige informanter mente at HOBS var en betydelig forbedring fra tidligere Excel-baserte løsninger. Flere informanter mente at HOBS var avgjørende for synlighet i logistikksystemet og trakk frem at det bidro til at sivile og militære fikk en enhetlig forståelse av logistikkbehov og -leveranser. Grad av synlighet påvirkes også positivt ved økende grad av integrasjon. Det at strategiske partnere var samlokalisert med – og integrert i – NLOGS, bidro til ytterligere synlighet under TRJE18.

Det ble imidlertid brukt både ugraderte og graderte verktøy for bestillinger og logistikk-planlegging, og det var uklart for mange hvilket verktøy som skulle brukes for ulike formål. I tillegg ble bestillingene og planene endret underveis. Dette førte til at man kun fikk fullstendig oversikt over behov og tilgjengelighet ved å flytte informasjon mellom de ulike verktøyene på ulike nettverk. På grunn av

manglende interoperabilitet og uklare retningslinjer for hvilken informasjon som kunne deles på de ulike verkøyene, ble dette i stor grad gjort manuelt, noe som ble svært tidkrevende, og bidro til å redusere synligheten i logistikksystemet. Når det gjelder det strategiske partnerskapet, så ble forskjeller i kultur og rutiner hos sivile leverandører og militære nevnt som årsak til misforståelser. Det omfattende omfanget av delordrer (FRAGO-er) som ble utgitt i Forsvaret i forbindelse med øvelsen, førte til utfordringer med å være oppdatert eksempelvis på endrede rutiner, noe som bidro til ytterligere reduksjon av synligheten.

Erfaringene fra TRJE18 viser at bruken av HOBS og koordineringsceller har økt synligheten i logistikksystemet, men at behovet for koordinering og oppklaring av mange årsaker likevel ble stort. Egenskapen *synlighet* vurderes derfor til gul.

Flexibilitet – Logistikksystemets evne til å tilpasse seg

Flexibilitet beskriver evnen et logistikksystem har til å tilpasse seg endringer i ytre rammefaktorer, omfang og oppgaver. For et militært logistikksystem med risiko for svært variable ytre rammefaktorer og omfang vil flexibilitet være en svært viktig egenskap for å sikre operative leveranser.

Den fremste endringen som påvirker flexibiliteten i Forsvarets logistikksystem er de inngåtte beredskapsavtaler med strategiske partnere. Gjennom disse avtalene får Forsvaret en helt annen tilgang til sivile logistikkressurser enn gjennom rekvisisjonslovgivningen og tradisjonelle avtaler uten beredskapsklausuler. Blant annet får Forsvaret tilgang på sivile logistikkressurser uavhengig av om og når rekvisisjonsloven trer i kraft, som ved opptrappingen til en krise. Strategiske partnere gir også Forsvaret mulighet for fleksibel og skalerbar tilgang på ulike typer ressurser Forsvaret selv ikke besitter. Under TRJE18 ble det stilt høye krav til logistikksystemets flexibilitet på grunn av stadige endringer i bestillingene. Blant annet ble nær 90 % av bestillingene innen forflytning og transport (M&T) endret i omfang, tid eller sted. Dette stilte særlig store krav til koordineringen mellom bestiller-nasjonene, NLOGS, RSOM-bataljonene og sivile transportleverandører. Endringsordrer og et høyt antall sene bestillinger stilte også krav til flexibiliteten til logistikksystemet. Gjennom øvelsen viste strategiske partnere at de hadde en skalerbar sivil ressurstilgang i de delene av landet hvor øvelsen ble gjennomført. Ifølge Garavelli (2003) er evnen til å takle endringsbestillinger og skalere leveransene etter oppdukkende behov sentralt for flexibiliteten i et logistikksystem. Strategiske partnere ble også brukt som en ressursbrønn for kompetanse og personell i SOR-organisasjonen da denne ikke ble oppbemannet med militære ressurser.

Logistikksystemet viste høy grad av fleksibelt under øvelsen med hensyn på endringer i logistikkbehov, skalerbarhet og bredde i ressurstilgang. Egenskapen *flexibilitet* evalueres derfor til grønn.

Rettidighet – Tidsriktig planlegging og organisering

Rettidighet i et logistikksystem betegner tidsriktig oppbygging av logistikksystemet og tidlig avklaring av deltagernasjonenes logistikkbehov.

Tidlig avklaring av omfang og funksjonelle krav til vertlandsstøtten tjener to sentrale formål. Det ene er mulighet til å levere vertlandsstøttetjenester det tar lang

tid å anskaffe. Eksempler på dette er de store midlertidige leirene med forlegningsplass til inntil 5000 soldater. Det andre formålet med tidlig avklaring av logistikkbehov er å skaffe tilstrekkelig tid til å gå ut i markedet for å forhandle frem konkurransedyktige priser. Dette bidrar videre til kostnadseffektivitet i logistikksystemet (OECD, 2013). Under øvelse TRJE18 ble vertlandsstøtteaktørene som er sentrale i tidlig planleggingsfase opprettet tidnok til å kartlegge deltakerlandenes behov og igangsette de mest tidskrevende infrastrukturprosjektene, som midlertidige leire. Flere aktører som ikke hadde noen formalisert rolle i planleggingen men som skulle få overført vertlandsstøtteansvar ved øvelsens start, som regional logistikkledelseenhetene (RLL), ble involvert relativt sent i planleggingen av mottaket. Dette gjorde at de ikke var tilstrekkelig forberedt på sentrale deler av mottaket. Konsekvensen av dette ble at ansvaret for enkelte av varekategoriene som skulle overføres til RLL-ene ble holdt i den sentrale SOR-organisasjonen gjennom hele øvelsen. RLL-ene fikk dermed ikke testet deler av ansvarsområdet de er gitt i styrende dokumenter.

Logistikksystemet gjennomførte rettidig etablering av flere, men ikke samtlige enheter internt. Det var altså enkelte avvik fra retningslinjer for å ta NLOGS fra beredskapsklar (Forsvaret, 2018). Dette fikk imidlertid ingen operative konsekvenser under øvelsen. Egenskapen *rettidighet* er vurdert til gul grunnet sen oppsetting og sen involvering av enkelte relevante aktører.

Kompetanse – Ivaretagelse av kompetanse

Riktig *kompetanse* er avgjørende for at et logistikksystem skal kunne gjennomføre leveranser og oppgaver i tråd med krav som stilles til kvalitet og effektivitet.

En viktig årsak til å inngå strategiske partnerskap, er at Forsvaret får tilgang på personell med et bredt spekter av logistikkompetanse som Forsvaret ikke har i egen organisasjon. Dette var svært synlig i forbindelse med det allierte mottaket på havner og flyplasser, der de strategiske partnerne bidro med havne- og flyplass-tjenester i tillegg til transport av personell og forlegning. I tråd med oppsettingsplanene skal FLOs operative struktur oppbemannes av personell fra forsvarssektoren og vernepliktige. Flere informanter mente at det var manglende vilje til å fylle FLOs struktur, og liten kapasitet med relevant kompetanse hos flere DIF-er. Beredskapsklausuler i de strategiske avtalene gjorde det mulig å benytte personell fra de strategiske partnere i de omfattende bestillerenhetene sentralt og regionalt. Både bestillerkompetanse og markedskjennskap blir trukket frem som kompetanseområder Forsvaret dro god nytte av. Personell fra de strategiske partnerne hadde tilstrekkelig kompetanse til å utføre store deler av både alliert mottak og relevante deler av vertlandsstøtten. Når det gjelder ledelsen av den sivile og militære logistikken, så er de fleste informantene enig i at det var tilstrekkelig kompetanse i NLOGS for å håndtere ledelsesoppgavene og de administrative oppgavene til logistikkoperasjonene under TRJE18.

I følge enkelte informanter var imidlertid militærspesifikk kompetanse innen M&T et eksempel på et område det var for liten kapasitet av i forsvarssektoren. Kapasiteten til å håndtere dette området i NLOGS ble lav i forhold til behovet, noe som førte til høy belastning på det militære personellet med relevant kompetanse. Store deler av vertlandsstøtteapparatet er enheter som ikke eksisterer i det daglige, men opprettes ved behov. Enhetene blir i stor grad bygget opp av nytt personell

ved hvert alliert mottak. Kontinuitet og ivaretagelse av kompetanse kan derfor være utfordrende hos strategiske partnere. Det er ingen garantier for at sivil personell som ble leid inn under TRJE18 vil være tilgjengelige for fremtidige store logistikkøvelser som Cold Response 2022 eller operasjoner. Dagens logistikksystem legger imidlertid godt til rette for tilgang på sivil kompetanse som har vært nyttig i vertlandsstøtten. Det er likevel utfordringer knyttet til tilgang og ivaretagelse av militærspesifikk kompetanse innen logistikk for de mest omfattende operasjonene. Det kan derfor være nyttig med en avklaring på hva som bør være kjernekompetanse innen logistikk for Forsvaret, og hvilken kompetanse som kan dekkes av strategiske partnere.

Basert på erfaringene fra TRJE18 evalueres egenskapen kompetanse til lysegrønn.

EVALUERING AV OPERATIVE KRAV

Hvordan påvirker endringer i logistikksystemet operativ evne?

Ved å gjennomgå åtte observerbare egenskaper ved logistikksystemet under øvelse TRJE18, vurderer vi i hvilken grad logistikksystemet oppfyller til de fem operative kravene som ble listet opp i tabell 2. Basert på erfaringene fra TRJE18 vurderer vi at Forsvaret har *tilstrekkelig logistikkapasitet til å håndtere et alliert mottak samtidig med Forsvarets egen styrkeoppbygging* i et omfang på nivå med TRJE18 eller noe større. Selv om denne evalueringen ikke har kvantifisert potensiell maksimal kapasitet i logistikksystemet, var det tydelig at det var sivil restkapasitet under TRJE18. Gjennom beredskapsavtaler med strategiske partnere har Forsvaret fått bedret tilgang på logistikkapasiteter de manglet i egen struktur og bygget opp redundans innen ressurser de allerede har. Tilgang på sivil kapasitet og kompetanse kan potensielt frigjøre militære ressurser til logistikkoperasjoner i et operasjonsområde hvor det kun er mulig å bruke militært personell. Ettersom disse vurderingene kun bygger på empiri fra øvelse TRJE18, vil det være usikkerhet heftet ved logistikksystemets kapasitet ved andre ytre rammebetingelser som varslings tid, varighet på mottaksperiode, geografi, omfang av allierte styrker og sikkerhetssituasjonen der militære styrker skal understøttes.

Overordnet vurderer vi at Forsvarets nye logistikksystem bidrar til *økt evne til logistikk-understøttelse av operasjoner i hele landet*. Dette skyldes blant annet at strategiske partnere har kapasitet og daglig drift i samtlige landsdeler. Den sivile kapasiteten på tjenester og materiell er langt lavere i nord enn resten av landet. Om logistikksystemet kan dekke vertlandsstøttebehovet i hele landet er derfor usikkert. Forsvaret må derfor vurdere å ha tilstrekkelig egen kapasitet, eller inngå avtaler for å overta sivil kapasitet i nord. Kapasiteten i nord ble i liten grad utfordret under TRJE18, og viste seg å være tilstrekkelig for å understøtte de utenlandske styrkene som øvde der.

Basert på TRJE18 vurderer vi at strategiske partnere bidrar til at logistikksystemet får økt *logistikkberedskap* noe som bidrar til bedret reaksjonsevne. TRJE18 var en varslet øvelse med lang planleggingstid. Vi kan dermed ikke bruke empiri fra øvelsen til vurdere om logistikksystemet har en reaksjonsevne i tråd med styrkenes klartider, ettersom dette i liten grad ble testet. Grunnlaget for å vurdere reaksjonsevnen blir dermed evalueringene av de egenskapene i logistikksystemet

som bidrar til økt reaksjonsevne. Beredskapsavtaler med strategiske partnere gir rask og skalerbar tilgang på infrastruktur, varer og tjenester, og gir økt logistikkberedskap. I tillegg er egenskapene fleksibilitet, integrasjon, enkelhet og synlighet avgjørende for en effektiv ressursutnyttelse og en responsiv og effektiv logistikkjede. Logistikksystemet har gjennom TRJE18 vist høy grad av fleksibilitet og evne til raskt å håndtere oppdukkende oppgaver. Erfaringene fra TRJE18 viser imidlertid at logistikksystemet har forbedringspotensial med hensyn til enkelhet og synlighet. Økt enkelhet og synlighet vil kunne redusere tid og ressurser brukt til koordinering og kommunikasjon, noe som igjen kan gi reduserte reaksjonstider.

Basert på innsamlet empiri vurderer vi at logistikksystemet *potensielt kan ha evne til å understøtte en operasjon med en varighet på flere måneder*. Også denne vurderingen er heftet med betydelige usikkerheter, da logistikksystemet kun ble testet fire måneder under TRJE18. Øvelsen viste likevel at Forsvaret kan gjennomføre vertslandsstøtte til allierte styrker i et betydelig omfang over en lengre periode. Logistikksystemet har god kapasitet, høy grad av fleksibilitet og styringsorganer som kan bemannes og forsterkes etter behov. Økt synlighet og enkelhet gir mulighet for bedre ressursutnyttelse noe som kan bidra til å øke logistikksystemets utholdenhet.

Som øvelse ga TRJE18 ingen mulighet til å teste om logistikksystemet kan gjennomføre operasjoner i et bredt spekter av scenarioer – fra fredstidsoperasjoner til krig. Øvelsen viste at Forsvarets logistikksystem kan levere logistikk i et stort omfang over lengre tid i en fredstidsoperasjon. Beredskapsavtalene med strategiske partnere gir Forsvaret tilgang på logistikkressurser for et bredere spekter av konfliktscenarier. Disse avtalene forplikter leveranser fra strategiske partnere både i krisesituasjoner der beredskapsloven fortsatt ikke er trådt i kraft og i de mest alvorlige situasjonene. Vi vurderer derfor at endringene som er gjort i utviklingen av det nye logistikksystemets potensielt kan føre til økt evne til å levere logistikk i alle typer situasjoner, både daglige operasjoner, krise, konflikt og krig.

DISKUSJON OG KONKLUSJON

Denne artikkelen presenterer først et nytt rammeverk for å evaluere et militært logistikksystem med hensyn til operative krav og deretter bruk av rammeverket på Forsvarets logistikksystem basert på erfaringene fra Trident Juncture 2018. Det er empirisk utfordrende å vurdere hele logistikksystemets evne til å dekke de fem overordnede operative kravene i et dimensjonerende omfang. Test av utholdenhet og reaksjonsevne for hele logistikksystemet kan av flere årsaker ikke gjennomføres i praksis. Rammeverket er utviklet for å kunne vurdere dette indirekte ved å gå omveien via egenskaper. Ved å studere logistikksystemets ytelse innen ulike egenskaper under TRJE18 har vi testet bruksverdien av rammeverket. Rammeverket er svært nyttig for å evaluere de operative kravene, og det kan benyttes både for å studere enkeltdeler, eller enkelte nivåer i logistikksystemet og for å studere helheten. Vi mener at rammeverket har nytteverdi utenfor forsvarssektorens logistikksystem, og egner seg godt til å evaluere logistikkleveranser i øvelser og operasjoner som sivile beredskapsorganisasjoner deltar i. Rammeverket er derimot mindre egnet til strategisk utvikling av logistikk løsninger, ettersom det trolig vil omfatte et noe annet sett med kriterier, inkludert sikkerhetskrav.

Ved å benytte det nye rammeverket basert på en særdeles god tilgang på primær- og sekundærkilder, har vi evaluert vertslandsstøtten under TRJE18 med hensyn til åtte ulike egenskaper knyttet til ressurstilgang, prosesser og kostnads-effektivitet i det nye logistikk-systemet. Evalueringen gir et overordnet bilde av hvilke områder logistikksystemet som fungerer godt og hvilke områder som har et forbedringspotensial. TRJE18 var en fredstidsoperativ øvelse med små sikkerhetsutfordringer, uten angrep langs kommunikasjonslinjer eller bruk av omfattende irregulære virkemidler som sabotasje, terrorisme og cyberangrep. I en reell situasjon må det forventes at logistikksystemet blir utsatt for fiendtlige handlinger i større eller mindre grad. Av graderingshensyn har vi imidlertid ikke vurdert sikkerhet i denne artikkelen.

Den overordnede vurderingen av det nye logistikksystemet er at strategiske partnerskap gir økt logistikkapasitet i hele landet, noe som bidrar til økt evne til å dekke operative krav 1, 2, 4 og 5. Det at de strategiske avtalene inneholder konkrete beredskapsavtaler, øker muligheten for å dekke krav 3, å ha en reaksjonsevne i tråd med styrkenes klartider. Den økte ressurstilgangen fører dessuten til at Forsvaret kan benytte en større andel av eget personell i geografiske områder der sivile, av sikkerhetsmessige årsaker, ikke kan operere. Samtidig kan strategiske partnere for eksempel benyttes i mottaksområder som er tilstrekkelig langt fra operasjonsområder. TRJE18 viste at Forsvaret kan løse vertslandstøtteoperasjoner på en svært god måte og at Forsvaret har høy leveringsevne. Ved å studere de ulike egenskapene ved logistikksystemet ble det imidlertid avdekket et behov for å synliggjøre grensesnittene mellom sivile underleverandører, militære enheter og sivile myndighetsaktører på regional nivå. Det var i tillegg flere prosesser som involverer Forsvarets logistikksystem som var ineffektive. Eksempelvis fremstår roller, ansvar og myndighet i enkelte prosedyrer og prosesser som uklare, flere digitale verktøy mangler interoperabilitet og det manglet kapasitet på personell med enkelte typer kompetanse. Dette kan føre til redusert evne til å oppfylle de operative kravene, og er derfor noe som bør undersøkes nærmere.

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Peer reviewed article

Case Studies of Performance Based Logistics in the Military: International Lessons Learned

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Abstract

Performance-based logistics (PBL) represents a support strategy for weapon systems and manifests in contracts that focus on the delivery of outcome performance not process outputs. Despite the high research interest in the underlying theory, only few studies address the question how PBL is actually used. Some quantitative studies have researched this question by evaluating the perceptions of involved management people. Other data, such as prices, contract terms, or performance indicators, are often only available in form of qualitative case studies. Therefore, the purpose of this research is to report on a number of PBL cases and to provide a holistic view on their characteristics and the effectiveness as a support strategy. The analysis identified a high number of more than 100 cases that are reported in the literature. Filter methods are used to identify heterogenous case examples. The chosen cases are described and analyzed considering contract terms, price mechanisms and performance indicators. The findings show the wide range of PBL applications in international weapon system support. This guides this research to a number of research and practical propositions.

Keywords: Performance-Based Logistics; Weapon System Support; Case Study; Lessons Learned

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1. INTRODUCTION

Already in 2001 the Department of Defense of the United States of America (US-DoD) described performance-based logistics as the “preferred approach to product support” (US-DoD, 2001, p. 4). Since then, PBL has been used to increase availability and reliability of weapon systems while sustainment costs were stabilized or even reduced (Lucyshyn and Rigilano, 2019). A couple of studies already evaluated the effectiveness of PBL and provide empirical evidence on the positive effects of PBL, when properly implemented (e.g. Gansler and Lucyshyn, 2006; Guajardo et al., 2012; Boyce and Banghart, 2012; Lucyshyn et al., 2016).

PBL changes the traditional “pay for parts and services” approach of weapon system support towards a contract that is linked to expected performance outcomes (Mooney and Sanders, 2018). The details of the PBL approach are reviewed below, but what is of interest here is that PBL is not only a topic for the US-DoD. Since its emergence, the concept is used and implemented by a number of other countries. In particular, the United Kingdom or Australia are mentioned with specific incentive strategies that support PBL effectiveness (Mooney and Sanders, 2018). Case examples are reported from Germany (Kleemann et al., 2013), India bought Rafale fighter jets from France with PBL support (Walia, 2019), and the concept is also discussed in the context of Nordic countries (Listou et al., 2019).

The first passages of this article refer to the effectiveness of PBL and its applicability to various contexts. This reasoning is generally positive. However, some PBL pitfalls exist. First, PBL in the US-DoD is backed and encouraged for many years, but PBL contracting in the USA is still relatively rare and PBL contract numbers appear to decline since its peak in 2005 (Lucyshyn and Rigilano, 2019; Mooney and Sanders, 2018). This could be a warning signal that despite empirical evidence of PBL effectiveness, the concept might be outdated or at least the “hype around PBL” has reached a peak. The question is, if this is due to a lack of effectiveness.

Second, studies revealed that PBL is implemented in quite different ways (Glas et al., 2013). Thus, there is not only “one” PBL, but several configuration alternatives. For example, US DoD uses financial incentives in form of financial rewards or penalties, but also uses PBL in form of fixed-price contracts and surprisingly even cost-plus or pain-gain-share agreements (Hunter et al., 2018). Besides financial incentives, also time-based incentives are applied, because for a supplier the continuation of a business relationships is a main issue. This incentive is found to be a primary PBL incentive in some countries, e.g. Australia (Hunter et al., 2018). Overall, the diversity of PBL configuration alternatives might confuse and provokes the question which configuration fits best to a specific weapon system.

Both aspects guide this article to investigate how PBL is actually used. As already mentioned, some studies have researched this question (e.g. Lucyshyn and Rigilano, 2019). Often studies focus on the perceptions of involved management people (e.g. Glas and Kleemann, 2017; Gelderman et al., 2017). In addition, contract data of defense projects, such as prices, contract terms, incentives or performance indicators, are hardly available. This is why this article focuses on reported qualitative case studies. Therefore, the purpose of this research is to report on a number of PBL cases and to provide a holistic view on their characteristics

and the effectiveness as a support strategy. By applying this method, this research investigates the following research questions in accordance with case study research approaches (Yin, 2014). The first research question is addressing the effectiveness of PBL incentives, while the second question is focusing on time dynamics of PBL development.

- RQ1: Why incentives lead to an increase in effectiveness in the PBL case?
- RQ2: Why usage of PBL may have stalled and how will its application develop in the future?

Effectiveness is a measure for how well a goal is achieved. PBL usually aims at achieving performance goals which are operationalized with indicators such as availability, reliability, robustness, lead time etc. (Glas et al., 2018). This work is focusing on effectiveness, not on efficiency. Efficiency is measure for how much effort is required to achieve a goal. Already by its name PBL is performance-oriented. Thus, it is plausible to examine PBL from an effectiveness perspective. If effectiveness is not achieved, any other discussion about efficiency would be obsolete.

The remainder of the paper is organized as follows: We first give insights into PBL and its main characteristics in section 2. Next, the applied methodology of case study research is explained in section 3. This is followed by the case insights in section 4. Section 5 combines the insights to a meta-perspective. This is also the basis for the discussion and implications section 6. Finally, we provide conclusions and give details on limitations in section 7.

2. PERFORMANCE BASED LOGISTICS IN WEAPON SYSTEM SUPPORT

In weapon systems support, PBL is often sold as a completely new approach. However, roots of the approach can be traced back to the 1960s (Glas et al., 2013). Research is addressing the phenomenon, but the discussion uses several terms to describe it: “performance contracting”; “outcome-based contracting”; “performance-based logistics”; “performance-based payment”; “availability-contracting”; “incentive contracting” etc. (Selviaridis, 2011; Glas et al., 2013).

The essence of PBL stands for “outcomes are acquired through performance-based arrangements that deliver [weapon system] requirements and incentivize product support providers to reduce costs through innovation” (Defense Acquisition University, 2016, p. 6). The outcome is usually defined in form of metrics (e.g. availability, reliability, operability). In PBL we see a separation between the performance expectations (outcome goal), and the supplier’s way of implementation and how this goals is achieved (Kim et al., 2007). Thus, supplier efforts must focus on the achievement of the given goals. “The key to a successful PBL arrangement is the use of incentives to elicit desired behaviors and outcomes from the [supplier...]” (Defense Acquisition University, 2016, p. 11).

Every contract is providing a specific form of incentive to a supplier. Recent research, following Hunter (2018), has shown that in PBL financial incentives, but also time-based, scope-based or relational/other incentives are feasible. Thus, PBL includes monetary reward or penalty systems (bonus/malus payments), but also

incentives that are related to the extension of a contract duration or the extension of the contract size and scope. This research work is fully aware that incentives in a contract are a complex topic. The insights into the cases will show that time-based incentives (e.g. options for additional contract duration) are used together with financial incentives. However, this article focuses on financial incentives and tries to evaluate how these incentives effect supplier behavior.

Supplier behavior then leads to contract outcomes. The contract outcomes in PBL are often not only influenced by the supplier. Other influencing factors are simply how often, how intense and under which conditions weapon systems are used. Nevertheless, outcomes are measured via performance indicators that are related to requirements in the contract. These metrics are availability, reliability, operability and Glas et al. (2018, table II and III) provide overviews with already used key performance indicators. Management control is also an (relational) incentive.

However, it is assumed that financial incentives which are linked to performance metrics are the main source for motivation effects on supplier behavior. It is stated that the most challenging element of a PBL is the pricing model (University of Tennessee and Supply Chain Visions, 2012). This is why the focus in this article is on financial incentives.

3. METHODOLOGY OF CASE ANALYSIS

3.1 Brief insights into case study research

This research applies case study research as the major methodology. A case study is defined as an “empirical inquiry that investigates a contemporary phenomenon (the “case”) in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident” (Yin, 2014, p. 16.). Thus, it is the aim to better understand the phenomenon in its context.

This suits very well to the topic of PBL, which is a phenomenon often discussed as a single concept or strategy, but in fact it has a diversity of configurational alternatives. Furthermore, weapon systems and weapon system support systems differ from country to country. Therefore the exploration of PBL through case study research is justified.

Often case study research is examining a single case. However multiple-case design have increased in frequency in recent years and according to Yin (2014) multiple-case designs have specific advantages in comparison to single case studies and in comparison to quantitative survey. First, the evidence derived from multiple cases is perceived more robust and external validity is enhanced. Second, multiple cases allow to cross-evaluate and combine findings. In contrast to multiple respondents in a survey, insights from multiple cases is not testing a cause-effect, but allows to examine a cause-effect in-depth in different contexts. The examination of a phenomenon in multiple cases is also called replication design.

This suits very well to the aims of this research. PBL is an innovation as it provides new approaches to weapon system support. Countries /armed forces adopt PBL for individual weapons systems in a specific manner and in a specific configuration setting. Therefore, each PBL can be subject of an individual case study, but the study as a whole covers several PBL and thus uses a multiple case design (see also Yin, 2014, p. 56).

3.2 PBL case population: An initial quantitative view

Before examining cases in order to address the research questions, this section focuses on the overall population of PBL cases, of which data is available. PBL has its routes in the USA, so we have a strong look on the situation in the USDoD. PBL is described as the preferred product support strategy, but surprisingly “PBL is not being aggressively pursued” (Lucyshyn and Rigilano, 2019, p. 345). The number of PBL has decreased since its peak in 2005 of around 200 PBLs in place to around half the number of 87 PBLs in 2012 (Erwin, 2013). This means that “only 5 percent of the (US) military’s maintenance work is performed under such deals” (Erwin, 2013). Figure 1 shows that PBL contract obligations of the USDoD gradually declined after its peak in 2013 (data extracted from Hunter et al., 2017).



Figure 1: PBL contract obligations in billion US-\$ (constant 2016), Data from Hunter et al. (2017)

Besides the PBL in the USDoD, the author of this article has identified in his research another 100 PBL contracts. The collection of cases was an initial step of this research approach. Of these cases, some are from the public sector (e.g. police equipment, rail maintenance, infrastructure), but there are also PBL for weapon systems in other countries. The cases have been identified through publications in academic journals (e.g. Priva Datta, 2011 with two cases on aircraft spares or Kleemann and Eßig, 2013 with five cases). However, most cases are only presented with vague or very limited data. This prohibits a quantitative cross-case analysis with all cases.

However, both figures (87 reported contracts of the USDoD and 100 identified international cases from the literature) point to the same issue: In face of hundreds or thousands of other contracts (it is mentioned above that PBL in the USA has a share of 5%), PBL seems to be a niche approach, as the number of contracts is relatively low. This fits to the argument that each PBL is unique and PBL is customized because “one size does not fit all” (Geary and Vitasek, 2008; Glas et al., 2013).

The configuration of PBL depends on how incentives are understood (Mooney and Sanders, 2018). Some voices acknowledge that every contract provides a specific incentive structure, but propose to focus the PBL discussion on contracts that use a bonus/malus payment scheme (Glas et al., 2013). Other voices describe PBL as an approach that can use the whole range of price mechanisms: Cost plus, (firm) fixed price, and incentive price scheme (Lucyshyn and Rigilano, 2019, p. 350). Through the incentive mechanism, a PBL supplier is getting a specific profit opportunity and takes over a specific amount of contract risk. Therefore, the understanding of incentives is crucial for PBL. Data on the use of incentive schemes show that the majority of PBL in USDoD are firm fixed price (68% of all contracts, Hunter et al., 2017). Besides the payments scheme, there are also time-based or relational incentives available to configure PBL. Contract continuation and more intense cooperation are to mention here. However, those incentives are often not strong, because the level of competition for PBL contracts is low. Hunter et al. (2017) showed that 78 percent of USDoD PBL contract obligations have been awarded without competition. In a single source situation contract continuation for weapon system support is not a strong incentive, because the supplier is more or less set. Competitors are often not entering the market, because they would need to establish a new supply chain. Therefore, the core configuration variable of a PBL is the price incentive mechanism and this research will show how this is executed in the cases. Obviously, suppliers in a non-competitive market are risk averse, thus reluctant to PBL. Defense acquisition officials are also risk averse. Thus the implementation of the incentive structure is a key challenge than needs to be overcome as a good PBL should be in the interest of both parties.

The initial quantitative view on PBL cases reveals that PBL is seemingly a niche strategy for weapon system support, while on the other hand there is a range of configurational alternatives to form PBL. The major variable is the price incentive mechanism. Both aspects (*niche strategy* and *PBL diversity*) might explain, why the literature is still fragmented and most research addresses the topic with abstract mathematical modeling or in-depth single case study methodologies (Selviaridis and Wynstra, 2015).

3.3 PBL case selection

Following the multi-case study research design, it is the purpose to select cases that have the same phenomenon, of course, but differ in their context and content. Yin (2014, p. 58) recommends to select around 4 cases or more to investigate contrasting insights for assumed cause-effects. The guiding two research questions aim clearly to explore different and contrasting reasons, why incentives increase effectiveness of weapon system support and why PBL implementation has stalled.

To get valid and objective answers, the selection of cases in multiple-case study research designs is quite similar to how an experiment is designed. In a series of an experiment several observations are taken with a dependent variable that is influenced by independent variables. In an experiment some observations are taken without and some with a change in the independent variables (stimulus). If the dependent variable changing, then the experiment has shown the cause-effect from the stimulus to the dependent variable. Similarly, case selection in multiple

case study designs aims to identify cases that have clearly different contexts and case contents. Then, it might be possible to identify reasons why results in the cases differ, because the differentiating factors are known.

The following figure 2 illustrates the chosen cases. It is depicted that case background is located either in the USA or in Germany. Besides, the level of application differs and ranges from parts/components to the system level. In addition, the case context differ, because object of analysis (recipient of PBL service) is also heterogenous and ranges from single to multiple aircraft fleets and also includes a land-based rocket launcher system. Furthermore, the case content also differs. Contract duration and incentive structures as well as fleet size and other characteristics differ. The characteristics of each case are presented in more detail in the analysis section.

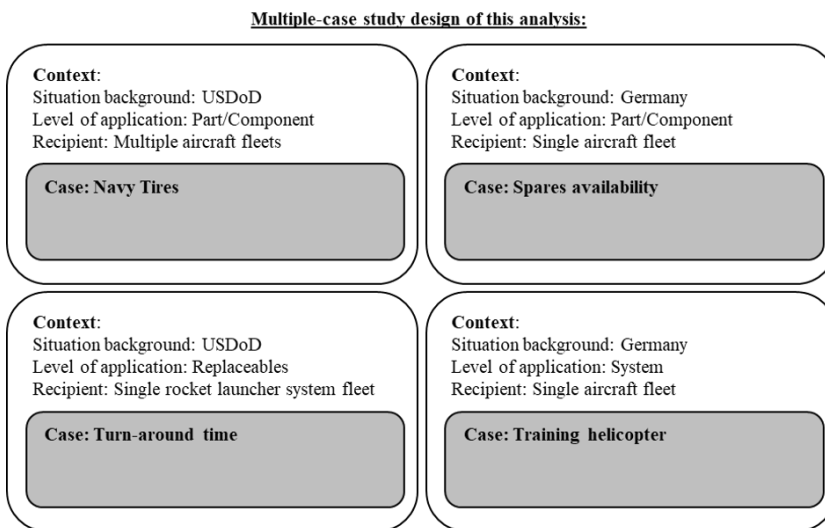


Figure 2: Cases and contexts analyzed in this research.

3.4 PBL case data

Data for the case analysis has been collected by means of literature analysis. For each case at least one major source of information has been identified. The data presented in the source is enriched with other data from academic literature on the same case. General data of the weapon system and on its usage life-cycle are also added from other publications. Overall, this research did not collect primary data on the cases, e.g. through interviews, observations or other empirical methods. Data gathering is following the analysis of secondary data.

Secondary data is the analysis of data that was collected by someone else for another purpose (Johnston, 2014). The use of existing data provides several opportunities for researchers, e.g. saving of time and resources but also simply getting access to a specific phenomenon. This is relevant here, because research

in defense economics is generally challenged by confidentiality requirements and limited data access. However, analyzed secondary data had initially another focus. Therefore, “secondary analysis of data requires a systematic process that acknowledges challenges of utilizing existing data” (Johnston, 2014, p. 625).

This research generally follows the generic procedure according to Johnston (2014): (1) Develop the research questions, (2) Identifying the dataset, (3) Evaluating the dataset and assessing the quality with regards to consistency, reliability, validity, objectivity.

4. CASE PRESENTATION AND ANALYSIS

4.1 Case 1: Navy Aircraft Tires

This case refers to Navy aircraft tires. The major source of information of this case is the report of Lucyshyn and Rigliano (2019). The case context has been enriched with other publicly available sources.

Traditionally, aircraft tires have been bought in bulk on basis of contracts for individual types of tires. Then, the tires were stored until they were needed, what resulted in large inventory stocks. On the other hand, specific tires still were scarce and stock-out was a severe risk. Tire availability was 81% before entering into the PBL, what was perceived as a severe bottleneck.

The Navy developed and implemented a PBL on component level. It started with an initial firm-fixed price contract starting in April 2001 and now lasts on until today. Contract duration was five-years with two five-years options. The first supplier, Michelin Aircraft Tires Corporation, was responsible to supply all types of aircraft tires that the Navy used. The contract had two extensions in 2005 and in 2010, so the PBL contract ended in 2016 after 15 years. The follow-up contract was competitively awarded to another supplier, Lockheed Martin. It was also a firm-fixed price contract and contract duration of three years with two options of six months each. Contract values have been \$67.4 million (1st phase), \$92 million (2nd phase), \$101 million (3rd phase), and \$131.3 million (4th phase with new supplier).

The contract requirements were to achieve a 95% on-time fill rate within 48 hours in the US and within 96 hours outside the US, while also other objectives are mentioned, e.g. reduction of inventories, demand flexibility of up to twice the monthly demand rate, if required.

The source provides data, that the contract was effective, because all requisitions were filled. In 2011 over 289,000 tires have been delivered worldwide and the supplier Michelin Aircraft Tires Corporation managed to consistently exceed the on-time delivery metric with a level of around 98.5%. Customer wait time was 32.1 hours within the US and 59.5 hours outside the US. Also Lockheed Martin managed to exceed the on-time delivery metric consistently with 98.2% within the US and 98.7% outside the US.

To achieve the set contract requirements, suppliers established specific management and execution structures, e.g. data exchange was established that allowed real-time demand status monitoring. Also, a service center that is available 24/7 was established. Besides, a monitoring system was established that provided insights into delivery times, inventory accuracy, and order fill time as well as transport carrier performance.

These are indications that the supplier is incentivized through the firm-fixed price to invest in reliability improvements, thereby reducing future costs. But the incentive is framed by the contract duration. “Generally, PBL contracts of shorter duration will not incentivize significant contractor investment since the contract must be long enough for the contractors to recoup their investments” (Lucyshyn and Rigliano, 2019, p. 368).

4.2 Case 2: Spares availability

The next case refers to the weapon system EUROFIGHTER and a specific support contract. The major source of information for this case is a joint position paper of the German aerospace industry association (abbreviated BDLI) and the German Bundeswehr (BDLI, 2018). However, presented data to the case is limited in that source. Besides, additional information to the case context is given by several reports of the German-Ministry of Defense (D-MoD), e.g. D-MoD (2019 and 2020).

Traditionally, the responsibility for all tasks related to the supply of the weapon system with parts and components was on the side of the German Bundeswehr. These tasks included the management of parts and components, procurement, storage, transport, and the planning and monitoring of the cycle of replacement parts. Other countries that use the weapon system have specific support contracts in place, which focus on availability. In particular, the United Kingdom awarded in 2009 a “contracting for availability” PBL support for their fleet to BAE systems (BAE Systems, 2020). That support in the UK also comprises logistics services such as the monitoring and management of all day-to-day operations to deliver spares and repair services (BAE Systems, 2012). The German Bundeswehr was confronted with challenges in the supply of the weapon system. Official publications mention “problems in the operational readiness” (D-MoD, 2015) and public media frankly talk about lacking spare parts (Gebauer, 2015). Thus, the Bundeswehr implemented a PBL contract to address this problem.

The contract (Eurofighter Vertrag C#3) has a duration of five years, but the source from 2018 mentions that the PBL just has been started. The contract situation is still in the transition phase. The supplier is taking over all supply chain management task (transport, storage, repair and overhaul of replacement parts). The contract requirements were to meet a material availability KPI, which is measured in response time frames of one hour, one day and 30 days. Within the 30-days timeframe, the objective is set to achieve a material availability of 99%. Similar to the above mentioned approach in United Kingdom, the contractor is also providing services on air force bases with own personnel. The main source of information is not providing any indications how the payment and incentive scheme is implemented in the case. But there are some general remarks on PBL in that paper: “It is ideal solution for PBL to link outcome-oriented KPIs with economic incentives” (BDLI, 2018, p. 7). Following the classification that the EUROFIGHTER-PBL is seen as PBL in the narrower sense, it is assumed that there is a reward scheme implemented in the case (bonus linked to material availability).

Overall, the case shows positive effects of PBL. In an official report, the Bundeswehr states that PBL in the EUROFIGHTER case has significantly in-

creased the availability of ready for operation aircrafts (D-MoD, 2020, p. 9). More specifically, that report mentions that the EUROFIGHTER fleet saw an increase in the fleet availability ratio of +60% (D-MoD, 2020, p. 4).

4.3 Case 3: Turn-around-time

This case refers to a rocket launcher weapon system called HIMARS (High-mobility Artillery Rocket System). The major source of information for describing the case is the report of Lucyshyn and Rigliano (2019).

HIMARS entered prototype production in 1999 and series production in 2003. The system is referred to as the most advanced artillery system in the U.S. arsenal. It is a wheeled and thus very mobile rocket launcher on basis of an armored truck. Already in 2004, when the first HIMARS launchers entered into service, a first PBL contract has been awarded by the Army to Lockheed Martin (around 195 launchers), while HIMARS at the Marine Corps (around 40 launchers) was supplied outside that contract. The objective of the PBL was to optimize or reduce costs while having flexibility in operational requirements. Compared to the weapon system support for the preceding system M270 MLRS, inventory management, reserve stock, repair and overhaul, depot maintenance etc., was not executed by the military, but by the PBL supplier.

The first HIMARS contract had a duration of three years (one base year and three option years). The volume was \$96 million. In a second contract, Army and Marines systems were supported. That contract lasted for three years (one base year with two option years) and had a volume of \$90 million. A third contract extended the PBL support until 2014 and had a volume of 158 million. Then, USDoD decided to transition weapon system support for HIMARS to a traditional cost-plus contract. This transition is of peculiar interest.

The supplier took over the full support responsibility. This included on the one hand side even the optimization of HIMARS usage. Data analysis revealed already in the first contract, that HIMARS launchers are used very different. Categorization in less used systems with low operational support tempo, and more used systems with high operational support tempo helped to reduce costs. On the other hand, the supplier efforts also referred to personnel embedded at military sites (called field service representatives). That personnel had a number of tasks, but a major advantage was to repair HIMARS very quick. Branded “Fix Forward”, field representatives repaired around 50% of all HIMARS on-site. In addition, logistics costs were saved, because field representatives were trained to open replacement components. So only parts or components need to be shipped instead of the whole replacement component.

The PBL was a firm-fixed price contract with performance incentives for state-side operations. If performance requirements were met, an additional fee was paid to the contractor. For overseas operations a cost-plus fixed fee contract was used.

The PBL contract contained three metrics: system readiness, response time for part delivery, and repair turnaround time. System readiness objective was 92% in the first contract, and 90% in the second one. This metric was not include in the third contract. Delivery time was measured in percent of delivered parts within a timeframe and priority group. For example, demands in in priority group 1 had to

be fulfilled within 48 hours within USA and 96 hours outside USA in more than 92% of cases (see Lucyshyn and Rigliano, 2019 for more details).

The third metric is of peculiar interest here. It is turnaround time and specified the time period for completing repairs for replacement parts. The requirement was set in working days (see table 1). In other words, 65% of all replacement parts have a turnaround time less than 36 days, and 92% of all replacement parts a turnaround time less than 80 days.

Table 1: Metric calculation in the rocket launcher case (data from Lucyshyn and Rigliano, 2019).

Band	Repair turnaround time	Requirement (percentage of total repairs)
1	1-7 days	≥18%
2	8-35 days	≥47%
3	36-80 days	≤27%
4	81-90 days	≤8%
5	91 days	1%

Overall, it seems as if the PBL was successful. System readiness was 99%. Spare parts delivery time was 14 hours within the USA and thus far below the requirement of 48 hours. Turnaround time in the field (by the field representative) took 1.2 days, only. Repairs at the site of the supplier took on average 34 days. The source of information also reports on calculations which measured total cost avoidance – only due to improved planning of operational tempo. Cost avoidance was \$8.6 million. Therefore, the contract seemed to be a success.

The major source of information further explains how and why the contract was changed towards cost-plus. This is also of peculiar interest for RQ2. It is mentioned that USDoD aimed to have more control. Direct control over stocks by the government and given stock objectives should help to achieve this. However, the source also provides some indication that supplier lost flexibility by this new arrangement (no optimized order quantities with sub-suppliers, no incentive to further invest into the program). Nevertheless, the source also acknowledges that performance under the cost plus agreement is still good. All metric requirements are (still) on a high level.

4.4 Case 4: Training helicopter

This case refers to the training helicopter system EC135 of the Bundeswehr and its support contract with the industry. The major source of information originates in a reader book on PBL from 2014 (Eßig and Glas, 2014) with specific chapters that describe the case (Haindl and Hänger, 2014; Muntz, 2014). Similar to case 2, additional information is added from reports of the German Ministry of Defense.

The helicopter fleet of 14 EC135 is located at one training center location. The helicopter is not for combat training but basic training, thus EC135 is also a commercial helicopter with around 1,000 systems sold in the world. The problem in this case was, that the budget for the operation of aircraft fleets in the Bundeswehr is of course limited. Even if the budget increases over time, it often does not keep pace with the general cost increase (Muntz, 2014, p. 170). A solution to the problem for the Bundeswehr was to concentrate on core tasks and efficiently execute non-core tasks. Training helicopters such as the EC135 are not within the core tasks, this is why Bundeswehr searched for a solution to economize costs while at the same time have the helicopters available in a very flexible manner.

The solution was a PBL contract in which the industry, namely Eurocopter (today Airbus helicopters), takes over the whole responsibility for the helicopter fleet. This included spare supply management, maintenance, repair and overhaul, tooling, inspections, documentation and other tasks. Only fuel-filling and usage (flying) are tasks that are performed by military personnel. All support processes are at the supplier side. The contract started in 2005 and had an initial duration of five years. In several extensions (five years, five years, seven years), the contract is now agreed until 2022. The contract payment scheme is “pay-per-unit”, a fixed price per flight hour (BDLI, 2018).

Overall, performance of the training helicopter is positively mentioned in the sources. The long-term ratio of mission-ready aircraft provision is above 80% (D-MoD, 2020). In a specific analysis, the ratio goes up to 99.4%, when not executed missions due to bad weather conditions or illness of pilots are not regarded (Haindl and Hänger, 2014). But the main objective was also to economize fleet operation costs. Information on this issue are rare, but Haindl and Hänger (2014) mention, that costs are far below (-50%) compared to the costs for a flight hour of the previous training helicopter BO-105. Thus, also this case shows positive effects of PBL.

5. DISCUSSION AND IMPLICATIONS

5.1 Cross-case comparison

Before we discuss the findings, this section summarizes the cases and provides a meta-view. Overall, the case analysis shows four PBL examples, two from Germany, and two from the USA. Case selection focuses on two PBL examples on parts/components level and two examples on system level.

In every case, a severe initial bottleneck situation is mentioned and the PBL approach shall address this issue. For navy aircraft tires and the spares availability case, the bottleneck is the low availability of spares, while stocks are existent but often not with material that suits demand. A different bottleneck exists for the other two cases. There, new systems are introduced and PBL shall help to avoid or at least stabilize weapon system support costs on the one hand side. On the other hand, PBL shall provide an instrument to safeguard a high contract performance even in changing conditions. In both cases, flexibility is provided and incentivized.

The cases from the USA show long overall contract duration with many contracts or contract option. In case one, two contracts with three options are identified through the main source of information. In case three, we see three

contracts and the first two contracts with an additional option. This is an indication that time-based incentives are also used to motivate the supplier, not only financial incentives. The same can be seen in the German cases, however, single contract terms are not below 5 years.

Every PBL has a key performance indicator, which is operationalized in several aspects. Navy aircraft tires measures on-time-delivery in hours and differentiate the area (USA, non-USA). In the EUROFIGHTER case, material availability is differentiated in three timeframes (one-hour, one-day, 30-days). The cases with the rocket launcher is the only one in this sample that uses several KPIs (system readiness, response time for part delivery, and turn-around time).

The KPIs are linked to a specific contract type/price mechanism. The range is from firm-fixed price (navy aircraft tires) to pay-per-unit-price (training helicopter), while the other two cases add financial incentives to other price mechanisms. All regarded cases are perceived as effective and successful. Three PBL are ongoing. Only one contract has seen a transition away from PBL towards cost-plus (see Table 2).

Table 2. Overview on the four cases.

	Navy Aircraft Tires	Spares Availability	Turn-Around-Time	Training helicopter
Country	USA	Germany	USA	Germany
Level	Parts / Components	Parts / Components	System	System
Initial bottleneck situation	Low availability but high stocks	Problems in the readiness of the fleet (due to lack of parts)	Cost avoidance while need for flexibility	Cost avoidance while need for flexibility
Duration (years)	(5+5+5) + (3+0,5+0,5)	(5+5)	(1+3) + (1+2) + 3	5 + 5 + 7
Sum duration (years)	19 (ongoing)	10 (ongoing)	10 (transition to cost-plus)	17 (ongoing)
KPI	On-time-delivery	Material availability	Turn-around-time (besides system readiness and response time part delivery)	Mission-ready aircraft preparation
Price mechanism / contract type	Firm-fixed price	Financial incentive is used	Financial incentive is used	Fixed price per flight hour
PBL effectiveness	Yes	Yes	Yes	Yes

5.2 Implications referring to RQ1: PBL incentives and effectiveness

Referring to the first research question, why and how incentives lead to an increase in effectiveness, the findings from the PBL cases support previous observations in academic and practice literature on the topic. First of all, it is to state that all observed cases have been effective. This is not surprising. Typically, PBL are reported as successful. E.g. Defense Acquisition University (2016) reports on 21 analyzed PBL, of which 20 have been effective and the sole program without improvements is marked with a footnote that malperformance is not due to the PBL arrangement, but due to other causes. The US Governmental Accounting Office published several critical reports on PBL, but usually it criticized badly implemented PBL (without good business case analysis, GAO, 2008) or the criticism was too early. In 2005 a report of GAO mentions that only 1 out of 15 analyzed programs showed improvements.

As we see in our case of the navy aircraft tires, it took quite a while in the case to achieve the performance goals. But overall, sources from the US indicate that PBL is effective. In the same manner, the German MoD is arguing. Considering the political tenor of the report, the preliminary conclusion to PBL is very positive (D-MoD, 2020). It is stated that PBL is another possibility to increase the operational availability of weapon systems. Furthermore that report clearly points out that PBL was successful for all mentioned cases in that report (e.g. EUROFIGHTER, engine NH90 helicopter, EC135 training helicopter, LUH SOF helicopter). This provides a clear indication that PBL is not only effective in the USA but also in Germany.

Overall, it seems as if the use of incentives and management by outcome-objectives is key for PBL effectiveness. However, we see that it is not only a financial incentive that is of relevance. Only two cases use these bonus systems. The other cases use fixed prices and link them with the effectiveness ratio. Combined with time-based incentives (contract extensions), this is also a suitable approach to incentivize a supplier to improve its PBL services for the Armed Forces.

5.3 Implications referring to RQ2: The future of PBL

Referring to the second research question, why the usage of PBL may have stalled and how its application will develop in the future, we have two different observations. To answer this question, we also refer to the “hype” and “business maturity” – issues that are used to assess new technologies or new business concepts (Fenn and Roskino, 2009; Dedehayir et al., 2016).

In the USA, only few percent of the (US) military’s maintenance work is performed under PBL (Erwin, 2013). Recent studies indicate that PBL is required, because there is still demand for reliable technology. However, PBL is not being aggressively pursued throughout the USDoD (Lucyshyn and Rigliano, 2019). However, it is the “preferred approach to product support” (US-DoD, 2001, p. 4). Overall, it seems as if PBL was and still is a niche strategy for specific weapon system (support challenges).

Challenges for PBL come from two main directions: First, criticism in early PBL-days focused on a potentially higher risk of security of supply and reliability (Gansler et al., 2011), but this did not prove to be founded. PBL supported systems

even operated in very dynamic conditions and companies did not per refuse to further support them. “PBL-supported systems operating in stressful environments have met or exceeded performance requirements” (Lucyshyn and Rigliano, 2019, p. 346). Second, critics of PBL focus a bit more on the effectiveness and efficiency of that weapon support strategy. This is in line with the reasoning mentioned by Selviaridis and Wynstra (2015), who question if performance-based incentives in long-term contract relationships are sustainable over time, because supplier ability to learn and to use innovation for service improvements become more and more marginal. That logic is convincing, because often the initial situation is characterized by very severe bottlenecks. Thus, PBL can achieve high initial improvements. As PBL is applied in the USA for more than 15 years, now, the question is, if PBL must achieve continuous improvements or sustainable high performance. If the latter is possible, then PBL is not stalled but focuses in its application fields of challenging niches of weapons system support.

In Germany, PBL is of course a niche strategy. The German MoD reports on only four explicit PBL applications for weapon system support, out of 68 major weapon systems (D-MoD, 2020). Referring only to these figures, then 5.8% of all weapon system support contracts are PBL in Germany, but there might be a dark figure of unreported cases (at subsystem level or for systems not counted as major weapon system. However, the PBL niche strategy is gaining momentum in Germany as it is considered as a future solution for industrial weapon system support in the German military aerospace strategy (D-MoD, 2016). Considering the high variability of the availability ratio per weapon system (new systems between 30% and 93%), mature systems (60 to 100%) and old systems (26 to 89%) it seems as if there are still weapon systems with significant deficiencies in their availability, what could be a starting point for a PBL weapon system support approach. There are no indications that Germany already reached a “peak” or “stalled” PBL implementation. Contrary, more and more official documents refer to PBL and recent papers explicitly give top-level support. For example, the German Air Force strategy (D-MoD, 2016) states that PBL is ground-breaking and international PBL experiences are paving the path.

Coming back to “hype” and “business maturity”, one could say that PBL in USA has still strong support, but the initial hype is over. On the other hand, PBL gained a higher level of business maturity. Methods and instruments to plan, arrange, execute, and monitor PBL are in place in the USA, e.g. PBL guidebook (Defense Acquisition University, 2016). This is why PBL is focusing on more specific fields of application, there. In Germany, it seems to be the other way round. PBL is gaining momentum, it is in a “hype”. On the other hand, PBL in Germany profits from foreign experiences. Business maturity of German PBL is quite high and similar to other international examples. Overall, German “enthusiasts” and USA “realists” have different perceptions of PBL to solve generally weapon system support problems, but in the USA as well as in Germany PBL still gains business maturity relevance or popularity (Stanley-Lockman, 2020). The findings of this analysis imply that the relevance is for specific and notably challenging weapons system support situations.

6. CONCLUSIONS AND LIMITATIONS

This article reports on PBL, if and why it is effective and if PBL is also a concept for the future. The case examples show that PBL is implemented in a heterogeneous way, what is named as PBL concept diversity. Nevertheless, all cases are effective, even if PBL implementation is different from case to case. This is also a potentially interesting field for future research. Next, the analysis and discussion show that even after decades of PBL existence (in the USA), the concept still gains relevance for future applications. In Germany many systems still are not treated with PBL, so only specific systems have been addressed up to now. In the USA, availability problems of a range of systems have been addressed in the past, so the future of PBL could address in more focused and sharpened application for more challenging performance objectives.

However, this research is also facing a number of limitations. First, empirical basis is limited with only four cases and each case builds on main sources of information. Second, the observed PBL may represent sub-types. More cases would enable a more fine-grained analysis on incentives and their effectiveness. Third, most cases are from aircrafts and only one case is from a ground-based system. A navy case is missing. Fourth, most PBL are very long-term projects. Every evaluation of their effectiveness is biased by time dynamics. Overall, future research should further investigate and elaborate the main finding of this work: PBL is effective, but it is a niche strategy for which the concept has a future!

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Peer reviewed article

Performance Based Logistics – A Norwegian-Swedish Perspective

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Abstract

Performance Based Logistics (PBL) as a support strategy for defence systems has been coined as a paradigmatic change within defence acquisition and maintenance. Originating from the defence industry, the concept has been adopted in many defence organisations. Although studies of its applicability has identified both enablers and barriers for implementation, these studies predominantly are performed in a few large nations. How the concept corresponds with a small state perspective needs to be addressed. Further on, perceived outputs of PBL practices would differ between the acquisition organisation, the supplier of PBL services, and the users of the services. Understanding these differences in perceptions would give valuable knowledge about how to design PBL contracts. Thirdly; assuming that PBL contracts indeed result in improved effectiveness, adapting the involved organisations to a new way of managing logistics should be accompanied by related organisational change processes. The purpose with this study is to contextualise the concept and define barriers and enablers for PBL in a small state perspective (represented by Norway and Sweden), identify different stakeholders' expectations for output, and explore whether implementing such a concept is perceived as a significantly new way of organising defence supply chains with an accompanying organisational change strategy.

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1. INTRODUCTION

“PBL, along with Total Life Cycle Systems Management have required a paradigm shift in how we view program life cycles and supportability”(Devries, 2005)

Since the Cold War ended, the defence sector, particularly the areas of military logistics and defence acquisition, has undergone a comprehensive transformation (Ekström, 2012). Factors such as New Public Management and the belief in a post-Cold War peace dividend led to reductions in defence spending and subsequently increased reliance of external actors and resources related to defence logistics (Listou, 2015). In this light, PBL was coined by the US DoD in 2001 (Berkowitz, Gupta, Simpson, & McWilliams, 2004; Devries, 2005) as a promising strategy for effective and efficient sourcing of goods, services and integrated bundles of goods and services (Datta & Roy, 2011; Kim, Cohen, & Netessine, 2007). The objective of PBL is to provide a contract structure that incentivises the supplier to increase operational availability and reliability, keep development costs under control, ensure profit margins for the supplier, and reduce the costs for the end user.

Reduced military spending motivated the defence industry to find new ways of making profit by developing their product offerings within the service and employment of military equipment. The trend to give new offerings still motivates the industry, foremost of competitive reasons and customer requirements. As such, PBL is closely associated with buying and selling “*performance*”, “*results*”, or “*outcomes*” in manufacturing and service industries (Hypko, Tilebein, & Gleich, 2010). An early example of PBL is Roll Royce’s “*Power by the Hour*” business model, in which the company is paid for providing maintenance services based on availability of the engine in terms of flight hours, rather than based on the cost of labour and spare parts (Neely, 2008). Contracts for availability and capability has been adopted by the US and European defence agencies as a performance-oriented acquisition strategy (Ekström, 2012; Ng, Maull, & Yip, 2009; Selviaridis & Wynstra, 2015).

Depending on the context of application, there is a wide variety of terms describing similar concepts. Alternative terms include “*outcome-based contracting*”, “*contracting for availability*”, “*contracting for capability*”, “*procurement of complex performance*”, “*performance-based service acquisition*”, and “*pay for performance*”. These terms are often used interchangeably, or applied in specific contexts, to highlight the shifting emphasis towards buying and selling results and outcomes. In this seemingly lack of congruence of terms, PBL seems to be the most commonly used term in the defence sector, particularly in the US (Fowler, 2008; Guajardo, Cohen, Kim, & Netessine, 2012). Hence, in this work we will use the term PBL.

PBL is applied in the defence sector in several countries, for a wide variety of contracts. Such contracts include maintenance, repair and overhaul (MRO) contracts for fighter aircraft in the US (DAU, 2005), spare parts provisioning for main battle tanks in the UK (Ekström, 2013) and simulators for training systems in Norway (Gulichsen *et al.*, 2011). However, most studies that outline the concept and content of PBL and identify barriers and enablers for implementing PBL, base their conclusions on experiences from the US and to some extent the UK. E.g., the two most cited PBL studies that discuss enablers and barriers for implementing PBL are based on surveys amongst PBL points-of-contacts in the US military ser-

vices, defence acquisition professionals selected from graduates from US Defence Acquisition University acquisition courses, and other personnel working with PBL within the US Department of Defence (Devries, 2005; Edison & Murphy, 2011).

We would claim that the applicability of the concept has not been sufficiently contextualised. Although the defence industry is a truly global one, the customers, i.e., the defence organisations of nations, exhibit heterogeneity both when it comes to size, legislation, financial arrangements, relationship climate, and business culture. (Ekström, 2012; Håbjørg, 2014; Kleeman, Glas, & Essig, 2012) ask whether experiences reported in existing empirical studies are transferable to other contexts. This research is based on experiences made in Norway and Sweden, which share a small nation perspective on PBL. The purpose of the research is to explore if conclusions identified in the literature are applicable and sufficient for PBL contracts in these nations. In particular, we are interested in exploring if reported barriers and enablers for PBL are universal, or if a small nation's perspective influences applicability and sufficiency.

This leads us to our first research question,

RQ1: What barriers and enablers to implementation of PBL are perceived as the most important in the Norwegian and Swedish defence organisations?

The objective of a military logistics system is to ensure that the allocated input is consistently transformed into the operational capability and operational effect (Kress, 2016). From a logistics point of view, operational capability can be operationalised as the efficient delivery of the required availability and preparedness in peace, and the effective delivery of sustainability in war (Tatham & Kovács, 2010). The system should have an inherent flexibility to manage the different logistics requirements in peace, crisis or war, and a robustness to cope with different forms of adversary actions in crises and war. This operationalisation corresponds to the three generic ways in which logistics creates customer value: efficiency, effectiveness and differentiation, which is the basis for our second research question:

RQ2: What types of values are generated through PBL from the respective perspectives of the buyer, the supplier and the end-users?

Thirdly, long-term relationships between the Defence and its PBL suppliers aim at creating value for both parties (Ng, Ding, & Yip, 2013). (Ng & Nudurupati, 2010) point to the importance of continually developing roles and expectations between contracting parties. According to (Kleeman et al., 2012) the social context would play an even more important role in PBL contracts compared to transaction-based contracts. Relations in long-term contracts develop based on interactions repeating themselves over time, creating mutual benefits of the cooperation (Ford et al 2011). Mutual benefits and longevity should be the foundations of PBL, on which efforts to optimise the supply chain and minimize risk builds (Vitasek & Geary, 2008). Optimising supply chains would mean to adapt the links and bonds between activities and resources, both within each actor in the supply chain, and between the organisations constituting the supply chains. Changing contractual mode from

a transaction-based regime to a partnering regime is therefore always accompanied by emergent or deliberate adaptations in intra-organisational dependencies. One would therefore expect that implementing PBL is accompanied by related change processes within the focal organisations (Sørgaard, 2017). Such effects have not been studied in identified PBL literature. By viewing the Defence as our focal actor, our third research question reads:

RQ3; Acknowledging implementation of a PBL contracting regime as a supply chain change process, is implementation of PBL perceived to be accompanied by deliberate intra-organizational change processes?

The remaining of the paper is organised as follows. In the next section it presents the research methodology. Thereafter the results from the study are presented, one research question at the time. Finally, the results are discussed, conclusions are drawn and suggestions for future research is presented.

2. METHODS

The number of PBL contracts in Norway and Sweden is still limited, and there are only few personnel with experiences from these contracts. We therefore find that following a qualitative research approach will give best access to relevant information. Our context is the application of PBL in Norway and Sweden, represented by three different contracts. These contracts all display different perspectives, which enable us to create a more nuanced knowledge. In this research we are interested in how PBL is perceived within the defence organisations. We will hence not include suppliers as informants.

The first contract is the administration of a Norwegian PBL contract from 2013, regulating maintenance and sustainment of the C-130J carrier aircraft for the Norwegian defence. This agreement is formally made between the Norwegian Defence Logistics Organisation (NDLO) and US Government (USGOV) as a Foreign Military Sales (FMS) case. This means that the USGOV assumes the role as a Product Support Integrator (PSI), and Norway receives the same level of service as US Air Force does without directly negotiating with the suppliers. The PBL contract came as part of the deal when Norway acquired these aircrafts.

The second contract is a Performance Based Contract involving the outsourcing of services for the Saab 105 (SK-60) jet trainer aircraft in the Swedish Armed Forces. Saab was awarded the contract through a Special Purpose Vehicle (SPV), and became the Prime contractor for operation and maintenance of the aircraft, through a “*power by the hour contract*”, from June 2009 until June 2017 with the option to extend until 2020. In the contract, the main aims are to “... (i) *establish a more cost-effective way of operation, (ii) accomplish increased flexibility and scalability, (iii) reduce risks, (iv) accomplish increased reliability*”. The contract between Saab and FMV (the Swedish Defence Materiel Administration) guarantees 6,500 flight hours per annum on four separate locations in Sweden.

The third contract is a maintenance agreement for the F-100 engine for the Norwegian F-16 fighter aircraft. A four-year contract was awarded in 2009 and renewed in 2013. This is an agreement between NDLO and the supplier Pratt &

Whitney (P&W). P&W assumes the role as PSI and hence is responsible for managing the upstream supply chain. The Norwegian F-16 aircrafts were delivered between 1980 and 1984 (in addition to two machines in 1987). Over the years, maintenance has been organised in multiple ways. The motivation for the PBL arrangement was to find novel ways to maintain operability at a lower cost.

The purpose of studying the C130-J and the F-100 contracts was to answer RQ1. The SK-60 contract is connected to RQ2, whereas information from all three contracts contributed to answering RQ3.

In total 75 informants were interviewed, selected based on their hands-on experience with PBL in Norway and Sweden. Each interview lasted from 60 minutes to 3 hours, following semi-structured interview guides based on factors identified in the literature. All interviews were audio recorded. After transcribing interviews, information was categorised and reduced into factors representative of the perceptions of the informants. The semi-structured interview guide employed for RQ1 (enablers and barriers) built on the factors discussed by (Devries, 2005) and (Edison & Murphy, 2011). During the data categorisation and reduction, we identified a new set of factors as presented in Table 2.

3. RESULTS

Although PBL is highlighted as a strategic option in Defence planning (Forsvarsdepartementet, 2015-2016), PBL contracts are still a minor part of the total defence planning and operation in Norway and Sweden. Practitioners ask many questions and have strong opinions about having suppliers deeply integrated into the support of defence systems. By presenting our results on the three research questions we will shed light to some of the questions that are asked, and to give arguments pro & con implementing PBL solutions.

3.1. RQ1: Barriers and enablers to implementing PBL

In 2004 (Devries, 2005) studied 27 US PBL contracts, and identified 14 factors that enables or inhibits successful adoption of PBL. He found a strong link between factors enabling the adoption of PBL and successful implementation of PBL. (Edison & Murphy, 2011) applied the same factors as Devries but added the factor “warfighter perspective”, related to readiness and operational demands. Devries ranked the factors based on the frequency distribution of enablers / barriers mentioned in each of the 27 contracts. Edison & Murphy asked their 300+ respondents to rate 15 factors as either enabler or barrier, then multiplied the ranking by the total number of respondents that selected that rating, and presented their total ranking of enablers and barriers. Hence, some of the factors have the same score. These findings are presented in table 1:

Table 1: Enablers and barriers. From (Devries, 2005; Edison & Murphy, 2011)

	Enablers		Barriers		
	2004	2011	2004	2011	
Warfighter perspective	N/A	1	Cultural paradigms	2	1
Performance metrics	1	2	Funding	1	2
Total Life Cycle Support Management	2	2	Technical data rights	3	3
Strategic alliance, partnership	5	4	Infrastructure, organisation	5	4
SCM	6	4	Statutory-regulatory requirements	2	5
Performance based contracting	2	6	Competence, education	2	<i>Enabler</i>
Incentives, awards	<i>Barrier</i>	7	Incentives, awards	7	<i>Enabler</i>
PBL awareness, training	<i>Barrier</i>	8			
COTS	2	8			
Total ownership cost	6	10			

In our study we discussed these enablers and barriers with respondents working with the Norwegian C-130J aircraft and the F-100 engine. We did not ask our respondents to rank these factors. Our findings showed that a somewhat different set of enablers and barriers seemed to be relevant. As outlined in the Methods section, our data analysis led to a new set of factors, characterised as Enablers, Barriers, and Context dependent factors. These are discussed below:

Table 2: Enablers and barriers for the C-130J and the F-100

Enablers for PBL	Improved deliveries, Information sharing, Relational trust
Barriers for PBL	Lack of a SCO / SCM perspective
Context dependent factors (either barriers or enablers)	Economy, Preparedness, Competence, Complexity, Strategy, Rules & regulations

The enablers

Improved deliveries: One of the basic ideas behind PBL as a concept is improved delivery and improved availability. Neither in the US nor in the UK surveys is the delivery itself highlighted as a factor that promotes PBL. We find that the respondents strongly agree that the availability of both components and the system has increased as a result of the PBL agreement and that the agreement has affected the delivery in a markedly positive direction. Since the F-100 agreement could report about improved and reliable deliveries, this gave the respondents a reassurance that a PBL solution could give the same effect also within the C-130J system. This is partly explained by the PBL agreement itself giving Norway a better priority with the supplier; *“then we are [...] in the supplier’s inner circle. We are a priority customer”*.

The agreements helped streamlining the value chain between customer and supplier, much because of good information exchange between customer and supplier. Improved deliveries could also be a result of the F-100 agreement being the first of its kind for P&W, who has shown great interest in marketing this agreement. In the same way, Norway is also early in terms of the C-130J, the Norwegian PBL agreement being one of the first of its kind. These conditions may mean that Norway, as a small player, has gained some additional advantages in the start-up phase.

Information Sharing and information flows were considered essential, and as the very basis for improved value chain utilization. For this to work, reporting must be sufficient and of good quality. This involves both contractual reporting regimes and internal routines. Good information sharing provides a basis for improved statistics and forecasts of resupply from suppliers. Within the F-100 agreement, one experienced that inadequate reports from the Defence in turn affected the operational delivery; without accurate information from the Defence, the supplier was not able to ship the necessary parts. The respondents on the C-130J could tell that through the PBL agreements and the open information sharing, the Defence received early information about production changes and future availability of parts and components from the suppliers. Such information was not available under the former transaction-based regimes. This can however also be attributed to a generally low availability of information in the Norwegian systems prior to the agreements; *“I think we have better control. Because we get weekly reports on the sharing access, and we get monthly reports on everything that goes on at the supplier side. Where the parts are, when they are expected to return [...] Quite impressive to get such detailed reports”*.

Relational trust: the UK based studies indicated a tendency for complex performance-based contracts to contribute to the development of in-group relationships where the parties worked together, unconditionally and as a collective towards a common goal (Guo & Ng, 2011). Our empirical evidence indicates a form of relational trust between customer and supplier. Whether the trust is based on relationships between individuals or institutionally between the Armed Forces and the suppliers is not clear from our findings. However, the limited data points toward that both play an important role. Institutional trust fosters individual trust and individual trust strengthens the institutional trust.

The barrier

Lack of supply chain orientation: Our findings are quite clear on that lack of a Supply Chain Orientation (SCO) is the only factor that indisputably is a barrier for implementing PBL. In the PBL literature, SCM is highlighted as a factor that promotes PBL. Its importance increased significantly in the US surveys from 200 to 2011. This is explained by the fact that those who worked with PBL better understood the important role of the SCM mindset in helping to implement PBL effectively (Edison & Murphy, 2011, p. 261).

These experiences reported in the literature run counter to the F-100 and C-130J empirical data, where all respondents pointed to challenges related to the supply chain and its management. The challenges are unilaterally found within one's own organization and not at the suppliers. Even if the operational availability increases with PBL, this presupposes that the Armed Forces as a customer does its part of the job. An illustrative example is the C-130J agreement where the supplier demanded "control" over the supply chain in order to guarantee delivery at all. Corresponding experience is found with F-100, where the supplier uses its own forwarding contracts because it does not trust the delivery through the Armed Forces' forwarding agreements. In addition, over the years the F-100 has had significant challenges in getting the material quickly enough through the Norwegian supply processes. Parts sent from P&W have on occasions taken several months from the time it was received at the NDLO warehouse until it was registered in the inventory management system. The parts cannot be used before they are registered in the system; *"we have had major delays in maintenance production because we have not been able to obtain parts that we know is physically located [at the warehouse]"*.

The ambiguous elements

In the US studies from 2004 and 2011, some factors evolved from being barriers to becoming enablers, first and foremost the factors Competence and Reward systems. This may be a result of maturation and learning in the organization (Edison & Murphy 2012, p. 261). Within the Norwegian and Swedish defence organisations there are both mature and less mature PBL cases existing side by side. Since these organisations have relatively little experience with PBL, it may be more difficult to objectively identify enablers and barriers for PBL. The perceptions of factors such as economy, readiness, competence, system complexity, strategy, as well as laws and regulations seemed to depend on the context in which they were assessed.

Economy: The Norwegian respondents believed that PBL could be financially advantageous in some areas, but that it not necessarily would lead to monetary savings for Norway, and especially not in the short term. A PBL contract transfers risk to the suppliers. The respondents were relatively clear that transferring risk to the supplier costs money. It is therefore with a certain scepticism that the respondents observed that PBL often is referred to as an economically favourable solution. Over-selling the economic aspects can contribute to the wrong focus being placed on what is achievable and hence be regarded an impediment to the effective implementation of PBL. *"What I believe, and what I hear is a simplified logic in relation to [savings]... now you have established this fantastic PBL of yours... who are we going to resign?"*

A PBL agreement transfers several functions to the supplier, but this does not mean that things get cheaper, because the job still must be done. Hence, PBL agreements themselves might not be more financially favourable than a transaction-based regime, but they can provide a significantly improved operational delivery and a priority for the suppliers - more bang for the bucks. The respondents further believed that PBL agreements provide predictability regarding planning and budgeting, and that an optimization of inventory through economies of scale could provide overall financial savings in the supply chain. The SK-60 project in Sweden show reduced cost, meeting the requirements of the contract, but at the expense of flexibility. In the end, it creates more value for money, but it makes it more difficult for planners who are responsible for utilising the jet trainers.

Preparedness does not seem to be an issue often raised in the PBL literature. Preparedness is a factor highlighted by the respondents, however not as one-sidedly problematic or one-sidedly positive; *“you are often bound to the suppliers regardless of contract mode. For example, Lockheed Martin owns the design of the C-130J, which means that the Armed Forces is locked to Lockheed Martin as the sole supplier of the J- peculiar parts (parts that are special to the C-130J model). Preparedness, knowledge and competence are no longer in-house. You are exposed when you put all this in one basket. But, in practice, we are, at least on the engine side, dependent on the OEM anyway”*.

The PBL regime on the C-130J has ensured Norway a priority on spare parts beyond what other nations achieve through their transaction-based contracts. The respondents argued that preparedness is improved *“because now we are part of the supplier’s inner circle - being a priority customer and receiving fast deliveries. We have dedicated personnel sitting with the supplier, who moves heaven and earth to ensure that we have access to parts [...] for instance, a part that otherwise has a 2-year lead time - they can provide it in 3-4 months”*.

One could think that PBL contracts, adapted to peacetime, can create challenges in a conflict situation due to lack of flexibility. In this sense, one could imagine situations where the supplier cannot fulfil contract terms and the larger states get first in line before the smaller states. (Gulichsen, Reitan, & Listou, 2011), on the other hand, believe that this is not unique to PBL contracts. This is a view shared by the respondents; *“Norway as a small state will always be at the mercy of other nations and great powers. We will never have a higher priority than the USAF [...]. However, it should be said that if we are in a live situation in a theatre, we get higher priority than ordinary American units that are not deployed”*.

Competence: Competence is highlighted in the PBL literature as a factor that can both promote and inhibit the effective utilization of PBL. The Norwegian respondents agreed that PBL requires a changed mind-set and another set of competencies. E.g., knowing how to define performance parameters instead of writing Statement of Works (SOW). PBL is complex and requires experience to become a smart customer. *“We are a smarter customer on this contract than we were when the first contract was signed. We could have been a smart customer back then also because we had a very skilled depot and very skilled people. We had good people in supply positions, but we were not familiar with the form of contract. And there was some stumbling and failure”*.

A strong driver for the PBL agreements on F-100 and C-130J was partly a difficult staffing situation and a lack of competence internally. These conditions were so prominent that they could be considered to have promoted PBL as a concept in the Norwegian Armed Forces. Organisational development took place before the choice of maintenance solution was decided. Our respondents indicate that PBL was being forced out because organisational change and lack of competence left the Defence without critical competencies. In addition, this happened apparently without a clear strategy behind it. *“One of the key questions to ask is what if we had an up-and-running supply element with sufficient manpower. Would we then go for PBL? I’m not sure. Because we would have a system that worked”.*

System Complexity: As in the US studies, the Norwegian respondents highlighted clear goals and performance measures as essential for PBL and regards this an important success factor. PBL agreements with clear objectives provide a better basis for clarification of responsibilities and roles and for performance measurement and statistics. Direct deliveries and well-established measurement parameters related to a predetermined number of available engines was considered almost revolutionary when the F-100 contract was entered into in 2009. Neither the Armed Forces nor the supplier, P&W, had experience with the equivalent. The contracting parties spent a lot of time setting these parameters and discussing how to interpret these in their own organizations. On the other hand, the Norwegian empirical evidence also suggests that increased complexity can inhibit the development and use of PBL, especially for complex systems already in stock. *The [PBL] can be anything (...) if you have large weapon systems then they must be designed for it, and you must have a supplier who understand this from the very beginning. I would never drive that race now against Lockheed for example with the F-16. The fuselage as such, it had never worked out. All too many subcontractors, all too many people...”*

Laws and regulations: US legislation says that a minimum of 50% of depot maintenance must be carried out organically (i.e., within the Defence organisation) and can therefore not be outsourced to commercial actors (Gansler & Lucyshyn, 2006). Such legal restrictions were not discussed by any of the respondents to any particular degree. Nevertheless, the respondents emphasized two regulatory factors as limitations on PBL. One was related to restrictions on the longevity of contracts. The Norwegian respondents were relatively unequivocal that PBL agreements should have a long duration to allow for mutual adaptations between customer and supplier. It was pointed out that such agreements were very time-consuming to negotiate, and that it takes time getting to know each other and making the agreement work optimally. The other concern is related to repurchase requirements. The respondents perceived that repurchase claims could potentially have stopped the entire F-100 contract, because it was not clear what kind of repurchase agreement could or should be established. It has not been possible to find literature from other nations that discusses repurchases related to PBL.

Strategy: None of the agreements examined had a PBL strategy behind them. Current PBL agreements have been prepared bottom-up, i.e., within the individual acquisition project, without any common approach to PBL for the entire Armed Forces (Dorn & Ekström, 2014; Forsvarsdepartementet, 2015-2016; Gulichsen et al., 2011; Hermansen, 2013). All respondents nevertheless experienced great

freedom of action, sufficient authority and support from the management to both choose PBL as a solution and to design and operate the contract in day-to-day operations.

In the United States, a great deal of work has gone into developing guidelines and tools for support and assistance in understanding PBL and in establishing and implementing PBL contracts. An example of this is the US Department of Defence PBL Guidebook (DoD, 2016). None of the Nordic respondents have had access to anything similar. At the same time, none of the respondents explicitly called for such a handbook. Our respondents indicate that challenges encountered during the contractual period could have been dealt with during the negotiation phase if the Armed Forces had had a PBL strategy.

3.2. RQ2: Perceived values

Perceived value is discussed in literature in terms of finding ways to write contracts, ways to measure achievements, and ways to identify and measure risks (Liinamaa et al., 2016; Selviaridis & Norrman, 2015; Selviaridis & Spring, 2018). To our knowledge, discussions concerning perceived value when changing from traditional contracts to PBL solution has rarely been explored. Maintenance of the SK-60 evolved from being a traditional in-house activity, to becoming a PBL contract with Saab.

A common view among the respondents from the Swedish procurement agency is that the most important value generated is that they now have 95% availability of the SK-60, a significant improvement. However, both the number of flying hours, and the number of operating platforms significantly decreased at the time the PBL contract with SAAB was signed. Increased availability should have been possible for the Armed Forces to achieve in-house when considering a 75 % decrease in flying hours, and a corresponding reduction of operating platforms. Fewer platforms in the air means more platforms to cannibalise or use as reserves when the operational platforms require MRO. What however is important, is the fact that an improvement was achieved. One could only speculate whether this could have been achieved in-house, and whether the necessary personnel and physical resources would still be available.

The cost for the SK-60 has been reduced by 30 % through the contract. However, and rather surprisingly, relatively few of the respondents list this amongst the most important values delivered by the PBL contract. In fact, some of the respondents even claim that this is something that the Armed Forces could have managed if they had kept operations and maintenance in-house. Respondents within the Swedish defence procurement organisation and the Swedish Armed Forces HQ agree that they now, because of the PBL, have an exceptionally good awareness of total cost on a yearly basis compared with what they had before the contract. In addition, they claim that since there is now only one service provider assuming the overall responsibility for operation and maintenance of the aircraft, procurement routines such as monitoring, evaluation etc. are simplified.

Another aspect that comes up as an unintended, positive effect of this agreement is the increased knowledge about how to contract for availability and how to engage in PBL.

A matter of great concern has been the different types of options that were included in the contract since this has generated increased costs. Since Saab does not really know what to design the service for, there are different alternatives for 2014, 2017 and 2020 in the contract and the respondents feel they have ended up paying more than what they should.

According to the respondents at Saab, the most important value is the increased capability to deliver what they refer to as “*Turnkey solutions*”, i.e. to deliver PBL. Now they have a reference project, which they market, and, as several of the respondents indicate, has already generated new PBL contracts for other areas and systems, which is in line with Saab’s overall strategy.

From a back-office planning perspective, it is now easier to administer the system than before, indicating an increased simplicity and reduction of administration. There are no longer any requirements for indexing and monitoring spare parts, calculations of labour hours, etc.

Most risks were allocated to Saab. According to the program manager at Saab, 22 risks were identified in the quotation. Of these, the most significant was the risk that the transfer of SK-60 should “*fail*”. Other risks were of a technical nature and related to the fact that the SK-60 is an old and complex system where many unforeseen things can happen, since the system has been operational for more than 40 years. Some risks were obviously difficult to transfer at all, especially risks associated with accidents, death and wreckage. In general, it can be argued that operational risk cannot be transferred to a private contractor at all. In order to resolve this situation, one of the respondents explained that some of the identified risks were left outside the contract and to be addressed and negotiated when and if they occur. The reason for this was to avoid unnecessary risk premiums in the contract.

As part of the PBL, the aircraft and spare parts were transferred to Saab, without any costs. However, ownership of the aircraft remains with the Swedish government since it proved to be legally complicated to transfer the ownership. As part of the incentive and reward sharing mechanisms, Saab was offered to sell flight hours to other customers, which could result in increased revenue for Saab, as well as royalties for the Armed Forces.

3.3. RQ3: PBL as organisational change

Our main impression is that our informants did not perceive that implementing PBL led to structural changes, at least not as major changes; “*we implement PBL, but we have the same organisation that we have always had [...] so maybe it isn’t PBL to its full extent, it might be just a half-way solution*”. Statements such as “*a large proportion of the maintenance capacity disappears, these workshops [...] are not needed anymore when we get the F-35 because we no longer will do the maintenance*” indicates that there indeed are organisational changes related to aircraft maintenance. However, these changes are perceived a consequence of the decision to substitute the F-16 aircrafts with the new F-35 aircrafts, and not so much related to the maintenance regime. Since the F-16 is being phased out, it is no surprise that maintenance of the F-100 engine also will be phased out.

One further interesting finding is that the respondents agree that the impact PBL would have on culture, competence and power structures within the organisation seems not to be recognised by the management layer; *“the top level does not see the consequences of this. They have just said that yes, this sound good, and so we implement. They do not understand what the change is about”*. One needs to be explicitly aware about what one wants to achieve by implementing PBL. If the expectations do not match what one gets, it will produce noise and an impression that the top levels in the Defence is not aware what the result actually will be; *“I don’t feel confident that the Air Force has expectations that are aligned with what is realistic to achieve”*.

None of our informants would characterise implementation of PBL as a radical change for the Defence. The implementation is rather seen as an incremental development; *“it is an evolution of what we already do on our legacy system, from being just about parts of the weapon systems to cover just about all of the systems”* *“I see PBL as a stepwise development because it started with sub systems at the F-100 engine, then evolved to full covering of F-35 [and AW101]”*. This seemingly runs counter to the marketing of PBL as something radical, a paradigmatic change compared to a transaction-based regime (Ekström, 2013).

4. DISCUSSION AND CONCLUSIONS

The motivation behind this research was to understand how a relatively new concept of buyer-supplier relations evolves and are adopted within a specific context. PBL is described as a paradigmatic shift in defence acquisition with the potential of reducing spending and at the same time enhance operational ability. Although being based in US defence industry and this industry’s close relations to the US Armed Forces, the concept is being embraced also by smaller nations. How this concept works for smaller nations is to a lesser degree investigated.

In RQ1 we asked what are perceived as barriers and enablers in a Norwegian and Swedish perspective. Previous studies concluded with 10 factors either promoting or inhibiting the implementation of PBL contractual regimes. In our study we also identify 10 factors, but partly with another content than those in previous studies.

Improved delivery, information sharing, and trust promote PBL. We believe that demonstrating success in PBL contracting make personnel working with the contracts more positive towards initiating new PBL projects. Ideally this should be accompanied by strategic guidance, which seems to be missing. Improved deliveries were not explicitly mentioned in previous studies. Findings in other studies place little emphasis on *information sharing* as an enabler for PBL. E.g., (Edison & Murphy, 2011) highlighted proprietary rights to technical data as a barrier to PBL. Discussions about proprietary rights to technical data can affect the flow of information between the parties. This was however not mentioned as a barrier for the F-100 or the C-130J PBL contracts. Rather, working closely together with an external partner seems to produce more, and better information related both to logistics planning and to the operational status of the assets in question. Information sharing seems to depend both on the information infrastructure (contractual arrangements and systems for inter-organisational information exchange) and the willingness to informally or ad-hoc share information across organisa-

tional borders. The willingness to share information could be attributed to *trust* between the parties. In a PBL regime the supplier controls a significantly larger information base than before, which could lead to information asymmetry between supplier and customer. At the same time, the supplier's responsibility for both the delivery and the product is linked to financial incentives to offset the information asymmetry. Our respondents did not experience significant loss of control. On the contrary, they felt that they had more control and information as a result of more information sharing at all levels. The US surveys from both 2004 and 2011 place little emphasis on trust (Devries, 2005; Edison & Murphy, 2011). This may indicate that trust is more important in Nordic countries than in the United States.

The issue of *Supply Chain Management* and a seemingly lack of a Supply Chain Orientation (SCO) within the Armed Forces was brought up as the significant barrier to successfully implement PBL. Such lack of SCO is probably not only related to PBL contracts, and probably not unique to the Armed Forces of Norway and Sweden. However, the contracts have been awarded to civil companies with which the Defence has collaborated for several years, and with USGOV, also a well-known partner. The uncertainty of entering into agreements with P&W and USGOV is rather low. In this sense, none of the agreements have been entered into with "unknown" actors, and the long-term nature of the relations may have had a positive impact on the choice of agreements. The PBL contract for the F-100 engine evolved from a long-term relationship with Lockheed-Martin, a relationship that started long before Norway procured the F-16 aircraft, and a relationship that will continue at least for the lifetime of the new F-35 fighter aircrafts. For the Swedish SK-60 a decision to create an integrated product team was made early in the process as a type of partnership. The relations between the Swedish armed forces and SAAB also goes a long way back.

In our second RQ we set out to reveal what types of values that are generated for the different actors involved in a PBL contracting regime. As reported, the SK-60 PBL contract was the first in the Swedish defence. Our study found quite different perspectives on the values generated. The *buyer* clearly focuses on quality, and therefore regards the contract as a success. The *supplier* is satisfied primarily because they now have a successful reference project on which they can pursue their strategy to move towards servitisation. The *end users* are, however, more ambivalent. While the Air force recognises the necessity to deal with the risk of obsolescence, they now must live with a significant decrease in flexibility as a consequence of the PBL. The study confirms that it is necessary to include the warfighter's perspective in the evaluation of a PBL. Without this input, the SK-60 agreement would have appeared to be an undisputed success story.

Our analysis provides additional evidence to support the prevalent view that the defence sector tends to focus on technical R&D rather than any other aspects of innovation. In terms of flexibility, the end-users (the Swedish Air force) experience that the aircraft is now a part of a civilian 9 to 5 system, not a part of an operational military system. Consequently, sorties now require much more planning in advance. However, the resources not working 9 to 5, i.e., Swedish Air force personnel, are now focusing on fighter aircrafts that are needed for combat readiness rather than on the trainer aircrafts, and, hence improving the overall operational capability.

In RQ3 we asked whether introducing PBL is accompanied with a corresponding organisational change process. The motivation was that PBL literature describes PBL as a paradigmatic change within defence acquisition. As such, the involved organisations would have to reorganise their way of doing business to reap the advantages of such a change. When implementing PBL, one needs to define what tasks both the focal organisation and its PBL partner should perform. Without such a basis a PBL concept cannot fully be utilised (Geary & Vitasek, 2008, pp. 26-27). Adopting PBL would lead to changes in both activity structures, processes, power relations, and competence needs within the supply chain. Lacking a true Supply Chain Orientation would be a barrier for successful implementation of PBL contracts, as indicated in RQ1.

Our findings suggest that PBL was not communicated as organisational change. Hence, one should not expect there to be a strategy for change, even though literature points to the need of leadership commitment to a change strategy to achieve a true supply chain orientation (Fawcett, Magnan, & McCarter, 2008), p. 104). The consequences of not communicating a related change strategy would be that organisational adjustments take place reactively because of the implementation, and not because of a planned change. According e.g. to (Balogun & Hailey, 2008) unclear top management involvement and vision will lead to increased resistance to change and less than optimal solutions. Some see PBL as a threat against their own tasks and power bases. To some, this threat indeed can be real. We see this partly in our findings; *“not everybody wants this [...] will see that this is a change, and then there will be much fuzz and conflicts”*. E.g., one of the more prominent challenges for the C-130J was the initial internal reluctance to engage in close cooperation across organisational borders, and challenges in gaining acceptance internally for the importance of inter-organisational cooperation. This may indicate that the understanding of how PBL affects the Armed Forces' own organization has not been emphasized sufficiently in the negotiation phase and operation of PBL contracts. Implementing PBL requires a cultural change within the focal organisation both to establish relations to the supplier and to be able to perform activities internally as outlined in the PBL concept. Such a change would need more management support if the full potential of PBL should be reached. Without a deliberate change strategy PBL could easily be perceived as an expensive concept with limited ability to streamline the Armed Forces' logistics activities.

To conclude, PBL in Norway and Sweden is perceived to lead to increased operability and better accessibility. Both Norway and Sweden are typically smaller nations, whereas the suppliers all represent a global, competitive defence industry market.

Differences in the perceptions of enablers and barriers are interesting both for the customer and the suppliers. For the Defence, knowing how personnel working with PBL contracts perceives the pros & cons of PBL would be valuable information when designing future PBL contracts. For the suppliers, understanding differences between different defence industry customers could help customising their value propositions. Merely accepting conclusions based on empirical data from other (large) nations may lead to misleading recommendations.

Based on our findings it seems that in a Norwegian and Swedish perspective,

relational aspects such as mutual institutional and interpersonal trust, rich information exchange and development and utilization of complementary competence play a more important role than identified in previous studies from other, larger countries. A somewhat incoherent approach to supply chain management, and hence how to optimise activity links and resource ties between the different actors in the supply chain could be the reason why there are some tensions between emphasising the economic and financial aspects of PBL and the contractual flexibility necessary for enhancing the operational effect of the contracts.

The absence of clear guidelines or handbooks explaining the process of developing such contractual solutions might explain why the change of contractual regime is not perceived as an organisational change process and hence not backed up with a formal strategy for organisational change. Implementing these PBL contracts could thus be seen as an emergent phase in which different approaches and solutions are tested out. Building knowledge about both the negotiation phase and the execution phase, and whether these differ between the Norwegian and Swedish business culture and that of other nations will produce valuable knowledge for future PBL contracts.

The number of PBL contracts within the Nordic countries is still limited. One needs to ask whether our findings truly reflect “standard” or “pure” PBL contracts. For the F-100 engine, this was one of the first PBL contracts made by the supplier. Likewise, for both the C-130J contract and the SK-60 contract our respondents indicated that part of the suppliers’ motivation seems to be to provide good showcases in their further marketing of their services. This might have affected the relative success of these Nordic PBL contracts. In addition, the C-130J contract was made as part of a FMS case, in which the Norwegian Defence piggybacks on the US Air Force. This obviously has implications for the bargaining power, which then might not be directly transferable to other nations of similar size. Further research is therefore needed to understand how smaller nations negotiate with large, global suppliers of defence assets.

At the time of writing both Norway and Sweden are in the process of acquiring more defence materiel under a PBL regime. Longitudinal studies of the development both of PBL strategies and of PBL contracts would therefore be interesting to perform as this would provide knowledge about how defence organisations change to adapt to new business models. In any future studies, a dynamic capabilities perspective may be of particular interest. Studies that examine enablers and barriers for MoD buyers and defence suppliers in long term PBL, as well as tracking the potential for service innovations in later phases of the process, are needed to further develop the themes explored in this research.

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Peer reviewed article

Guidance for the application of a dynamic purchasing portfolio model for defence procurement – A Swedish perspective

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Abstract

Purpose: The purpose of this paper is to develop guidance, including tactical levers, for the application of a dynamic purchasing portfolio model (PPM) for defence procurement.

Design/methodology/approach: The study uses a workshop and a literature review to identify suitable tactical levers for the application of a dynamic PPM for defence procurement. Based on application rules proposed in previous research (Ekström et al., 2021), the study then formulates guidance for application and validates the methodology in two desktop exercises.

Findings: The study identifies tactical levers and proposes guidance for the application of a dynamic PPM for defence procurement.

Research limitations/implications: The proposed guidance includes tactical levers, which will enable defence authorities to dynamically reposition in the segmentation model proposed by Ekström et al. (2021) and find an enhanced position to optimise. The presented results build on a study in the Swedish defence context. To determine generalisability, additional studies are required.

Originality/value: The paper develops guidance, including tactical levers, for the application of a dynamic PPM for defence procurement, which is original in several aspects. The guidance addresses public procurement, which is a novelty. In contrast to most extant PPMs, the model is dynamic, which enables practitioners to reposition in the model.

Keywords: Purchasing portfolio model, tactical levers, guidance for application, defence procurement, military logistics.

Paper type: Research paper.

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1. INTRODUCTION

The caution that “one size does not fit all” (Shewchuk, 1998) is now so recurrent in the supply chain management (SCM) literature that it has passed the status of postulate. It is progressively established in supply chain design (SCD) and supply chain strategy (SCS) development as a premise, which has implications for sourcing, operations and distribution (Christopher, Peck and Towill, 2006; Hilletoft, 2009). There is a similar premise in the purchasing and supply management (PSM) literature, regarding purchasing portfolio models (PPMs), where “formulating a single overall strategy for the purchasing function is a difficult task”, and a varied set of strategies and tactics may be required (Hesping and Schiele, 2015). In both PSM and SCM, researchers frequently address these premises through segmentation and differentiation. In their seminal contributions, Kraljic (1983) and Fisher (1997) introduce segmentation and differentiation into PSM and SCM, respectively, using two-by-two-matrices, or typologies. These seminal contributions have since their inception been modified, extended and contested. In PSM, authors such as Olsen and Ellram (1997), Bensaou (1999), van Weele (2006), Drake, Lee and Hussain (2013) and Rezaei, Wang and Tavasszy (2015) modify and extend Kraljic’s PPM. In SCM, authors such as Naylor, Naim and Berry (1999), Mason-Jones, Naylor and Towill (2000), Lee (2002), Christopher et al. (2006) and Vonderembsea, Uppalb, Huangc and Dismukes (2006) modify and extend Fisher’s strategy typology.

Two-by-two-matrices have been criticised in both the PSM and SCM literature. In PSM, authors criticise Kraljic’s PPM and its derivations for being too simplistic (Dubois and Pedersen, 2002; Hesping and Schiele, 2015, 2016; Lovell, Saw and Stimson, 2005; Rezaei et al., 2015). Similarly, in SCM, authors criticise SCS typologies for being too simplistic (Basnet and Seuring, 2016; Godsell, Harrison, Emberson and Storey, 2006; Hilletoft, 2012). As a response to the critique, researchers have proposed alternative approaches. In PSM, authors such as Cox (2015) develop significantly more complex models and methodologies. In SCM, authors such as Sharman (1984) and Yang, Burns and Backhouse (2004) develop strategy continuums, based on customer order decoupling point (CODP) positioning.

To avoid sub-optimisation in the supply chain (SC), Christopher et al. (2006) request holistic SCM, in which companies’ overarching objectives drive supplier selection, facility localisation and distribution decisions. This presupposes an all-embracing perspective, including both inbound and outbound logistics. However, with Drake et al. (2013) as a noteworthy exception, few authors merge contributions from PSM and SCM into a holistic SCM approach in response to the cautions by Shewchuk (1998), Christopher et al. (2006) and Hesping and Schiele (2015). Consequently, extant segmentation models and differentiation strategies predominantly address part of a SC, from a buyer’s or a supplier’s perspective, at the risk of sub-optimisation. PPMs that are more comprehensive are required (Rezaei and Ortt, 2012) and a combination of commercial and operational analyses is a step in this direction (Cox, 2015). Ekström, Hilletoft and Skoglund (2021) summarise the academic debate on PPMs in the PSM literature and identify open design and application issues. Building on a Delphi study in the Swedish defence context, Ekström et al. (2021) also establish design and application rules in the public defence context, and propose a two-stage segmentation model for defence

procurement. Ekström, Hilletoft and Skoglund (2020) summarise the academic debate on differentiation strategies in the SCM literature and propose eight SCSs that are acceptable, applicable and sufficient in defence SCD.

Building on Gelderman (2003, p. 21), Ekström et al. (2021) define a PPM as a tool that combines two or more dimensions into a set of heterogeneous segments and recommends different tactics and strategies for these segments. Accordingly, a PPM consists of a segmentation model, tactical levers, differentiation strategies and guidance for application of the model. While authors have developed several segmentation models and differentiation strategies (Hilletoft, 2009), comprehensive methodologies for complete PPMs are less frequent in the literature. Existing complete PPMs, including Kraljic (1983), Olsen and Ellram (1997) and Svensson (2004), focus on companies in the private sector. In contrast to the private sector, the public sector is not profit-maximising (Wilhite, Burns, Patnayakuni and Tseng, 2014) and defence authorities must achieve operational outcomes, not financial outcomes (Yoho, Rietjens and Tatham, 2013). Researchers have yet to understand the consequences of operational outcomes for SCD and Melnyk, Narasimhan and DeCampos (2014) call for more research to identify the unique SCD issues in military/defence.

In line with a methodology proposed by Hilletoft (2012), Ekström et al. (2020, 2021) take the first steps towards a PPM for defence procurement and propose a segmentation model and differentiation strategies suitable for defence SCD. Ekström et al. (2021) suggest that the application of a PPM for defence procurement should be dynamic, which requires dynamic tactical levers. However, extant PPMs are predominantly static (Persson and Håkansson, 2007), with static tactical levers, and researchers rarely address dynamic tactical levers in the literature (Cox, 2015). To propose a complete PPM for defence procurement, researchers have yet to develop dynamic tactical levers and guidance for application. This paper addresses these gaps in the literature. The purpose is to develop guidance, including tactical levers, for the application of a dynamic PPM for defence procurement. This paper operationalises the purpose through two research questions:

RQ1: Which tactical levers are suitable for repositioning in a dynamic PPM for defence procurement?

RQ2: Which guidance for application is required in a PPM for defence procurement to ensure practical relevance?

This paper takes the final steps towards a complete PPM for defence procurement. It contributes to PSM, SCM and military logistics theory and practise as follows. First, based on a workshop, open-discussion desktop exercises and the combination of contributions from the PSM and SCM literature, it proposes a set of tactical levers, which will be useful in defence procurement practise. Second, it proposes a dynamic methodology that will assist procurement managers to select appropriate SCSs based on operational requirements, the market's ability to deliver supplies on time and the limitations in the Armed Forces operational capability if the market does not deliver supplies on time. Third, it provides defence authorities and defence industry with an instrument that will enable holistic SCM and thus be

useful for defence SCD that aspires to begin with the customer's requirements and move backwards, in line with the suggestion by Christopher et al. (2006).

The paper is organised as follows. In the next section, it reviews the related literature on PPMs, segmentation models and differentiation strategies. Thereafter, it presents the research methodology. Next, it presents and discusses the results of the study. Finally, it explicates theoretical contributions, practical implications and limitations and proposes further research.

2. LITERATURE REVIEW

2.1 Purchasing portfolio models

PPMs trace their origins to the portfolio models introduced in finance by Markowitz (1952). This pioneering portfolio theory for the management of equity investments has since been influential for applications in other fields and disciplines (Turnbull, 1990). Kraljic (1983) took PPMs into PSM with the purchasing portfolio matrix. Since then, a key focus in the purchasing literature has been on finding ways to classify purchases to assist buyers manage portfolios (Terpend, Krause and Dooley, 2011) and scholars have proposed a number of models as guidance (Hilletoft, 2012). Prior to PPMs, ABC analysis (or Pareto analysis) was the only tool for differentiating between important and less important purchases (Gelderman and van Weele, 2005). The advent of the PPM thus presented the purchasing community with a powerful alternative. Researchers and practitioners frequently describe PPMs as appreciated instruments for developing differentiated purchasing and supplier strategies (Gelderman and van Weele, 2005).

By the definition employed in this paper, a PPM consists of a segmentation model, differentiation strategies and guidance for application. Based on this definition, most contributions in the PSM and SCM literature are segmentation models, differentiation strategies or a combination, whereas few contributions are complete PPMs (Luzzini, Caniato, Ronchi, Spina and Sousa, 2012). In the latter category, Kraljic (1983) proposes a complete methodology in four phases, classification, market analysis, strategic positioning and action plans. Olsen and Ellram (1997) propose a similar three-step approach, analysis of the company's purchases, analyse the supplier relationships and develop action plans. Svensson (2004) proposes a managerial process in four phases, analysis of business environment, analysis of relationship criteria, selection of relationship strategy and managerial decision of relationship strategy. Based on severe critique of extant models, regarding rigour, robustness and application, Cox (2015) advocate a more complex, dynamic approach, the sourcing portfolio analysis (SPA). In SPA, the methodology includes criticality analysis, static power positioning and sourcing strategies, dynamic power positioning and sourcing strategies.

2.2 Segmentation models

There is a longstanding academic debate on the topics of segmentation model design and application. Regarding design, traditional models have been criticised for having only two dimensions (Dubois and Pedersen, 2002; Hesping and Schiele,

2016; Lovell et al., 2005; Rezaei et al., 2015) selection of dimensions (Nellore and Söderquist, 2000) and for values of dimensions (Gelderman and van Weele, 2005; Olsen and Ellram, 1997; Ramsay, 1996). Regarding application, researchers have discussed if segmentation models should be prescriptive, or serve as catalysts for discussions among stakeholders (Gelderman and van Weele, 2003; Jarzabkowski and Kaplan, 2008) and if they should have segment-generic or purchase-specific strategies (Hesping and Schiele, 2015). The discussion also include strict or pragmatic application (Gelderman and van Weele, 2003; Hesping and Schiele, 2015) and static or dynamic application (Cox, 2015; Hesping and Schiele, 2015; Persson and Håkansson, 2007).

In a study in the Swedish defence context, Ekström et al. (2021) investigate practitioners' perspectives on these open design and application issues, establish suitable design and application rules and propose a two-stage segmentation model for defence procurement, which satisfies the operational requirements (Figure 1). The two-stage segmentation model builds on three dimensions and consists of a precursor and a two-dimensional model. To reduce complexity, the two-dimensional model merges sixteen elements into four segments, routine, delivery risk, operational risk and strategic supplies, which users should treat differently (Ekström et al., 2021).

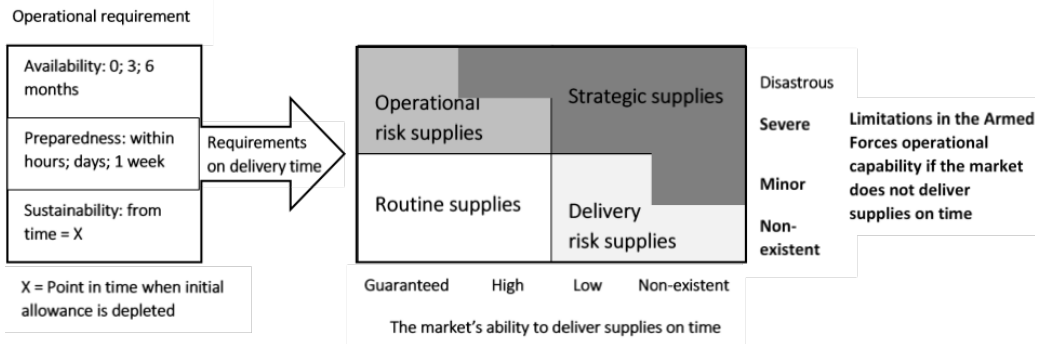


Figure 1: A two-stage segmentation model for defence procurement (Ekström et al., 2021).

Regarding application, Ekström et al. (2021) conclude that to satisfy the requirements of Swedish defence procurement practitioners, the two-stage segmentation model should be prescriptive for routine supplies and serve as a catalyst for discussions for all other segments, strategies should be segment-generic, whereas application should be pragmatic and dynamic. Of these application rules, dynamic application presents a particular challenge, since there are few detailed strategies and/or tactics identified in the literature to explain how practitioners can move to a more favourable position in a segmentation model (Cox, 2015). In addition, there are relatively few empirical investigations on which tactical levers that practitioners use for different segments (Hesping and Schiele, 2016).

2.3 Strategies and tactics

The concepts of strategy and tactics are central parts of PPMs, but there is no consensus in the literature regarding their application (Hesping and Schiele, 2016). Hesping and Schiele (2015) propose a hierarchical distinction, firm strategy, purchasing strategy (as one functional strategy), category strategy (for specific supply market), tactics (sourcing lever applied for specific category strategy) and supplier strategy (for specific supplier in a sourcing category). Using terminology from SCM, this paper discusses SCSs, which correspond to supplier strategies in the hierarchy proposed by Hesping and Schiele (2015). In addition, this paper discusses tactics in the context of static and dynamic leverage (Cox, 2015), which has overlap with tactics in the hierarchy, but which is not identical.

After segmentation, traditional, static PPMs, allow optimisation of a given purchasing situation, whereas empirical arguments support the idea of developing dynamic PPMs, which could offer improved situations to optimise (Persson and Håkansson, 2007). As a result, using extant models, managers frequently believe that they have accomplished their decision-making once they have performed the initial segmentation and are unaware of any repositioning possibilities (Cox, 2015). In contrast to traditional, static PPMs, dynamic tactical levers enables repositioning in the segmentation model in dynamic PPMs.

This paper equates tactics with dynamic and static tactical levers, corresponding to the first and second principle of leverage (Cox, 2015), which practitioners should apply immediately after the initial segmentation. Using dynamic tactical levers, practitioners can move to a more favourable segment in the model. The paper defines two types of dynamic tactical levers, reducing operational dependency and increasing market capability, which corresponds to moving down and left, respectively, in the two-dimensional model in Figure 1. The paper also defines one type of static tactical lever, risk analysis, which practitioners must perform when all opportunities for movement are exhausted.

When practitioners have exhausted all repositioning opportunities in the segmentation model, they must differentiate treatment by selecting a suitable SCS. A SC consists of all activities that manufacturers and distributors perform to create value, including purchasing, manufacturing and distribution (Chen and Paulraj, 2004; Hilletoft, 2009). SCs must service a wide range of products and markets and a recurrent caution is that “one size does not fit all” (Christopher et al., 2006; Lee, 2002; Lovell et al., 2005). A SCS specifies how a company enhances performance through competitive priorities, such as quality, flexibility, innovation, speed, time and dependability (Chen and Paulraj, 2004). SCSs must match the specific requirements of a product or a market (Christopher et al., 2006; Fisher, 1997; Melnyk et al., 2014) and customers’ requirements (Godsell et al., 2006).

Researchers have proposed SCS typologies, such as efficient/responsive (Fisher, 1997), postponement/speculation (Pagh and Cooper, 1998) and lean/agile (Naylor et al., 1999), which others have criticised for being too simplistic (Basnet and Seuring, 2016; Godsell et al., 2006; Hilletoft, 2012). In another stream of research, authors such as Sharman (1984) and Yang et al. (2004) have suggested SCS continuums, using the customer order decoupling point (CODP) position as a demarcation between different SCSs.

In the Swedish defence context, Ekström et al. (2020) find that commercial SCD-constructs, such as contingency variables, competitive priorities and SCSs, are acceptable and applicable, but not sufficient, in defence. Ekström et al. (2020) propose a set of eight SCSs, which satisfy the Swedish defence authorities' operational requirements (Table 1).

Table 1: Supply chain strategies for defence supply chain design (Adopted from Ekström et al., 2020).

SCS	CODP-position	Push-pull boundary	Postponement-Speculation	Agile-leagile-lean	Customisation-standardisation
Engineer-to-order (ETO)	Before design	Engineering (pull-only)	Pure (full) postponement	Agile (responsive)	Pure customisation
Buy-to-order (BTO)	Before purchasing	Purchasing	Purchasing postponement	Leagile	Tailored customisation
Make-to-order (MTO)	Before manufacturing	Manufacturing	Manufacturing postponement	Leagile	Tailored customisation
Assemble-to-order (ATO)	Before assembly	Assembly	Assembly postponement	Leagile	Customised standardisation
Package-to-order (PTO)	Before packaging	Packaging	Packaging postponement	Leagile	Customised standardisation
Ship-to-order (STO)	Before distribution	Distribution	Logistics postponement	Leagile	Segmented standardisation
Make-to-stock (MTS)	After distribution	Storage (push-only)	Pure (full) speculation	Lean (efficient)	Pure standardisation
Procure-to-stock (PTS)	At customer	Prestorage	Pure (full) speculation	Lean (efficient)	Pure standardisation

The first seven SCSs in Table 1 use names from the literature, from a supplier's perspective. However, engineer-to-order (ETO), buy-to-order (BTO), make-to-order (MTO), assemble-to-order (ATO), package-to-order (PTO), ship-to-order (STO) and make-to-stock (MTS) work equally well from a buyer's perspective, since buyers can contract suppliers to differentiate SCSs to satisfy their requirements. ETO is applicable for capability development (CAPDEV), which involves development of new, technically advanced systems, but not for operational requirements.

Depending on lead-time, BTO, MTO, ATO, PTO, STO and MTS may be expedient to satisfy some operational requirements, but not all. The complementary SCS, Procure-to-stock (PTS), is applicable for all operational requirements and may be necessary to satisfy requirements on availability and preparedness and to ensure sustainability until industry commences delivering replacement supplies. However, in addition to costs for procurement, operations, maintenance, infrastructure, distribution and personnel, PTS involves risk-taking regarding depreciation and obsolescence and should be used restrictively.

Table 2: Operational requirements versus supply chain strategies (Ekström et al., 2020).

Operational requirements	Proposed supply chain strategies							
	ETO	BTO	MTO	ATO	PTO	STO	MTS	PTS
CAPDEV	Match	Match	Match	Match	Match	Match	Match	Match
Availability immediately	Mismatch	Mismatch	Mismatch	Mismatch	Potential match	Potential match	Potential match	Match
Availability within three months	Mismatch	Potential match	Potential match	Match	Match	Match	Match	Match
Availability within six months	Mismatch	Potential match	Potential match	Match	Match	Match	Match	Match
Preparedness (mobilisation within hours)	Mismatch	Mismatch	Mismatch	Mismatch	Potential match	Potential match	Potential match	Match
Preparedness (mobilisation within days)	Mismatch	Mismatch	Mismatch	Mismatch	Potential match	Potential match	Potential match	Match
Preparedness (mobilisation within one week)	Mismatch	Mismatch	Potential match	Potential match	Potential match	Potential match	Potential match	Match
Sustainability	Mismatch	Potential match	Potential match	Potential match	Match	Match	Match	Match

Table 2 matches CAPDEV and the Swedish Armed Forces (SwAF) operational requirements with the proposed SCSs. The lead-time from order to delivery for military-specific supplies ranges from hours to years, depending on supply class and SCS. When the SwAF require replacement supplies depends on consumption patterns, which depend on time, activity, chance, or a combination. Consequently, Table 2 is illustrative, not prescriptive. It is not a decision-making tool, but serves as an illustration of which SCS that may be applicable. Prior to any decisions, defence authorities must analyse the different supply classes and, in some cases, individual supply items, to determine applicable SCSs, for each operational requirement. For a specific supply item, a combination of SCSs will probably be required to satisfy all requirements. In addition to matches and mismatches, which are certainties, Table 2 includes potential matches, which are uncertainties. Potential matches illustrate that a certain combination of operational requirement and SCS may be a match, depending on lead-time and consumption pattern.

3. RESEARCH METHODOLOGY

Ekström et al. (2021) propose a two-stage segmentation model for defence procurement and Ekström et al. (2020) propose a set of differentiation strategies for defence SCD. Ekström et al. (2021) also provide a set of rules for the application of a PPM for defence procurement. According to these rules, the PPM should be prescriptive for routine supplies and serve as a catalyst for discussions for all other segments, strategies should be segment-generic, whereas application should be pragmatic and dynamic. Based on these contributions, this paper develops guidance for the application of a dynamic purchasing portfolio model for defence procurement, to complete a PPM for defence procurement.

The application rule “dynamic application”, which includes analysis of repositioning opportunities in the segmentation model, requires elaboration. There are two directions in which to move to a more favourable position in the two-dimensional model, down and left, which corresponds to reducing operational dependency and increasing market capability. However, the application rules established by Ekström et al. (2021), offers no guidance regarding how to move in the model.

3.1 Workshop and literature review

As a first step, this study used a workshop, to review and extend the application rules established by Ekström et al. (2021). Of the fifteen workshop participants, seven represented the Swedish Armed Forces (SwAF), five the Swedish Defence Materiel Administration (FMV), one the Swedish Defence Research Agency (FOI) and two the Swedish Defence University (SEDU). The experts from the SwAF include the strategic, operational and tactical perspectives on military logistics. The experts from FMV represent the military, technical and commercial/legal perspectives on defence procurement. The researcher from FOI has long experience of research on logistics and procurement. The researchers from SEDU are officers, combining practical experience with a research perspective.

Using operational and commercial analysis, the workshop participants identified suitable dynamic tactical levers, which are different ways of moving in the segmentation model. The participants also identified appropriate static tactical levers, which are the remaining options when moving in the model is not possible. The study then conducted a literature review, to establish to what extent the literature can corroborate these findings and/or contribute with additional dynamic and static tactical levers.

3.2 Methodology development and testing

As the next step, the study combined the segmentation model and the application rules (Ekström et al., 2021) with the differentiation strategies (Ekström et al., 2020) and the identified tactical levers, to propose guidance for the application of a dynamic purchasing portfolio model for defence procurement. To test the resulting methodology, the study conducted two open-discussion, desktop exercises with two representatives of the SwAF and four from FMV.

The scenario involved the procurement of a particular, advanced type of ammunition. The study selected this ammunition since it represents current, complex defence procurement, with few suppliers and long lead-times, which means that the market's ability to satisfy all operational requirements is low or non-existent. In addition, the limitations in the Armed Forces operational capability if the market does not deliver on time is likely to be disastrous or severe. Consequently, users are likely to segment this advanced ammunition as strategic supplies, which is the segment that provides most challenges as well as opportunities for repositioning in the two-dimensional segmentation model.

During and after the first desktop exercise, the exercise participants evaluated the methodology in plenary, which resulted in minor revisions. No further revisions were required after the second desktop exercise. The researchers distributed the final methodology to twelve logistics and procurement experts in the SwAF and six procurement experts within FMV for evaluation and comments. There were no comments from the experts that necessitated any further revision.

4. RESEARCH RESULTS

4.1 Tactical levers

During the workshop, the operational analysis identified tactics 1a-e (Table 3) as potential dynamic tactical levers for reducing operational dependency. The commercial analysis identified tactics 2a-e (Table 3) as potential dynamic tactical levers for increasing market capabilities. Table 3 presents these tactics in the order in which the workshop participants discussed them during the workshop.

In cases when there are substitute supplies on the market, such as lower-grade commercial fuels, tactic 1a is a possibility. Tactic 1b is an option if there are two similar capabilities. If the actual capability is greater than the required, tactic 1c is an alternative. In some cases, it may be possible to modify the operational planning, to enable tactic 1d. When possible, armed forces strive for standardisation of, as an example, spare parts for different vehicles, which allows tactic 1e.

Occasionally, it is possible to find alternative suppliers, which permits tactic 2a. To contract suppliers to use buffer stocks of raw materials, sub-components, etc. and to position these stocks as close to the user as possible is an avenue that defence authorities can explore in tactic 2b. Tactic 2c involves contracting suppliers to decentralise production in order to reduce lead-times. Similarly, tactic 2d entails contracting suppliers to localise sourcing, storage and/or distribution. In tactic 2e, defence authorities can contract suppliers to increase production and/or distribution capacities.

When defence authorities have exhausted all opportunities to reduce operational dependency or increase market capabilities, it only remains to decide if the residual risk is acceptable, or not. In some cases, operational risk-taking, tactic 3a, may be motivated. When it is not, the only alternative left is tactic 3b, prestorage (procure-to-stock, PTS).

The ensuing literature review did not identify any corresponding tactics to tactics 1b-d, which is not surprising, since they have a distinctly military perspective. However, several authors discuss substitution and standardisation of

supplies, tactics 1a and 1e. As demonstrated in Table 3, the literature review also corroborated tactics 2a-e. Once topics for potential dynamic tactical levers were exhausted, the workshop participants identified tactics 3a-b as suitable static tactical levers. In line with Hesping and Schiele (2016), Table 3 refers to these static tactical levers as risk analysis.

Hesping and Schiele (2016) provide a comprehensive list of tactics that the literature on purchasing portfolio models recommend. However, with the exception of the tactics already suggested by the workshop participants, the literature review did not identify any further tactics that are suitable as dynamic tactical levers. Using terminology from the supply chain risk management (SCRM) literature, tactic 3a is risk acceptance and tactic 3b is risk avoidance. Similarly, tactics 1a-e and 2a-e are either risk avoidance or risk mitigation tactics.

Table 3: Tactics for dynamic and static leverage after initial segmentation.

Tactical levers	Tactics for dynamic and static leverage				
Dynamic	a	b	c	d	e
1. Reduce operational dependency	1a Identify substitute supplies ¹	1b Identify overlapping capabilities	1c Identify redundancy in capabilities	1d Modify operational planning	1e Standardisation of supplies ^{1,4}
2. Increase market capabilities	2a Supply base extension ^{1,2,3}	2b Inventory buffer stock ^{3,4} and position ⁴	2c Decentralise production ⁴	2d Localise sourcing ⁴ , storage ^{3,4} and/or distribution ⁴	2e Increase production capacities ^{3,4} and/or distribution capacities ⁴
Static	a	b	c	d	e
3. Risk analysis ¹	3a Operational risk-taking ⁵	3b Prestorage (Procure-to-stock, PTS) ⁵			

¹ Hesping and Schiele (2016); ² Cox (2015); ³ Basnet and Seuring (2016); ⁴ MacCarthy, Blome, Olhager, Srai and Zhao (2016); ⁵ Ekström et al. (2020)

4.2 Step 1: Selection of operational requirement to satisfy

Step 1 uses the precursor (Figure 1), which involves selection of which operational requirement that is to be satisfied. There are three types of requirements, availability, preparedness and sustainability. The Swedish government differentiates requirements on availability and preparedness between military units. They have three values each, immediately, within three months and within six months and mobilisation within hours, days, or within one week, respectively.

Requirements on sustainability follows once the armed forces has depleted supplies stored for availability and preparedness and involves a flow of replacement supplies for the duration of, for example, an operation. Sustainability requires a flow of supplies from external suppliers. The point in time from which this is required depends on consumption patterns, which differs between supply classes. The point in time when this flow can start varies between different supplies and depends on lead-times for production and distribution. To address the potential gap in time between depletion of supplies stored for availability and preparedness and delivery of replacement supplies from external suppliers, defence SCs must store sufficient replacement supplies. For each supply item, the output of Step 1 are answers to the questions “how much” and “when” for availability and preparedness and to the questions “how much”, “from when” and “for how long” for sustainability.

4.3 Step 2: Market and impact analysis

Based on the input from the precursor and an estimated consumption pattern, the market analysis addresses the market’s ability to deliver supplies on time. Staff in the SwAF and/or FMV with adequate market knowledge for a particular supply item perform the analysis, which results in one of four values, guaranteed, high, low or non-existent. The impact analysis clarifies the limitations in the SwAF operational capability if the market does not deliver supplies on time. Staff in the SwAF with requisite insights regarding the interrelatedness of logistics and operational capabilities perform the analysis, which results in one of four values, non-existent, minor, severe and disastrous. Market and impact analysis are independent activities, which the SwAF and/or FMV can perform as separate activities. However, they must combine the results as input to Step 3.

4.4 Step 3: Segmentation of supplies

Given the market and impact analyses, the SwAF and/or FMV positions the supply item in the two-dimensional segmentation model (Figure 1), which places the supply item in one of the four segments routine, delivery risk, operational risk or strategic supplies. It is advantageous if the staff who performed market and impact analysis execute the positioning in the model jointly.

4.5 Step 4a: Selection of supply chain strategies for routine supplies

For routine supplies, the PPM is prescriptive. No further cooperation between the staff responsible for segmentation, market and impact analysis is required. No in-depth discussions among other stakeholders is required. The responsible authority, FMV for advanced systems and the SwAF for all other supplies, procures supply items in accordance with the matching, or potentially matching SCs (Table 2). PTS is a match and ETO is a mismatch for all operational requirements. The potential matches for requirements on availability and preparedness depend on lead-times for different supplies. The potential matches for requirements on sustainability depend on lead-times and consumption patterns for different supplies and on duration and stage of an operation.

4.6 Step 4b: Selection of supply chain strategies for delivery risk supplies

For delivery risk supplies, the PPM is a catalyst for in-depth discussions among all stakeholders prior to any decisions. In addition to staff responsible for segmentation, market and impact analysis, other stakeholders from the SwAF and FMV are required to join a cross-functional team, or an integrated project team (IPT), to resolve legal, commercial, technical and operational issues regarding the interrelatedness of logistics and operational capabilities, including operational, commercial and risk analysis. From the SwAF this includes staff from the operational level, the Training and Procurement Staff (TPS) and the Joint Forces Command (JFC). From FMV, this includes the Logistics Division, the Commercial Affairs Division and the Legal Affairs and Security Office.

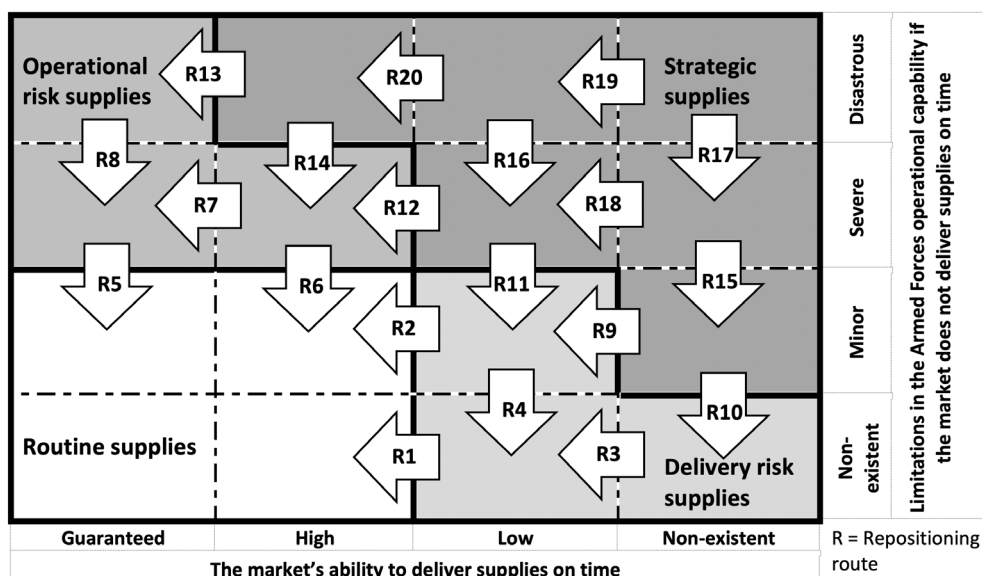


Figure 2: Repositioning routes in the two-dimensional segmentation model.

Immediately after segmentation, the IPT analyses opportunities to reposition the supply item to routine supplies by increasing the probability of delivery on time (Tactics 2a-e, Table 3). If possible, the IPT repositions the supply item to routine supplies (R1 or R2, Figure 2) and procurement follows in accordance with Step 4a. If repositioning is impossible, the IPT analyses if operational risk-taking is an option (Tactic 3a, Table 3). As part of this analysis, the IPT analyses if they can reduce the level of operational risk-taking by increasing the probability of delivery on time (Tactics 2a-e, Table 3) or by reducing the impact of failure to deliver on time (Tactics 1a-e, Table 3). If possible, the IPT repositions the supply item within the segment (R3 or R4, Figure 2).

If the remaining level of operational risk-taking is acceptable, the responsible authority procures supply items in accordance with the matching, or potentially matching SCSs (Table 2). PTS is a match and ETO is a mismatch for all operational requirements. The potential matches for requirements on availability and preparedness depend on lead-times for different supplies. The potential matches for requirements on sustainability depend on lead-times and consumption patterns for different supplies and on duration and stage of an operation. For each of the potential SC solutions, BTO, MTO, ATO, PTO, STO and MTS, the risk that the market fails to deliver on time is high. However, the limitations in operational capability if it fails are minor, or non-existent, which could justify operational risk-taking.

If increasing market capabilities and reducing operational dependency is unfeasible or unaffordable and operational risk-taking is at an unacceptable level, defence authorities must utilise PTS (Tactic 3b, Table 3). However, PTS is associated with extra costs and commercial risk-taking and defence authorities must use it restrictively.

4.7 Step 4c: Selection of supply chain strategies for operational risk supplies

For operational risk supplies, the PPM is a catalyst for in-depth discussions among all stakeholders prior to any decisions. In addition to staff responsible for segmentation, market and impact analysis, other stakeholders from the SwAF and FMV are required to join an IPT, to resolve legal, commercial, technical and operational issues regarding the interrelatedness of logistics and operational capabilities, including operational, commercial and risk analysis. From the SwAF this includes staff from the operational level, TPS and JFC. From FMV, this includes the Logistics Division, the Commercial Affairs Division and the Legal Affairs and Security Office.

Immediately after segmentation, the IPT analyses opportunities to reposition the supply item to routine supplies, by reducing the impact of failure to deliver on time (Tactics 1a-e, Table 3). If possible, the IPT repositions the supply item to routine supplies (R5 or R6, Figure 2) and procurement follows in accordance with Step 4a. If repositioning is impossible, the IPT analyses if operational risk-taking is an option (Tactic 3a, Table 3). As part of this analysis, the IPT analyses if they can reduce the level of operational risk-taking by increasing the probability of delivery on time (Tactics 2a-e, Table 3) or by reducing the impact of failure to deliver on time (Tactics 1a-e, Table 3). If possible, the IPT repositions the supply item within the segment (R7 or R8, Figure 2).

If the remaining level of operational risk-taking is acceptable, the responsible authority procures supply items in accordance with the matching, or potentially matching SCSs (Table 2). PTS is a match and ETO is a mismatch for all operational requirements. The potential matches for requirements on availability and preparedness depend on lead-times for different supplies. The potential matches for requirements on sustainability depend on lead-times and consumption patterns for different supplies and on duration and stage of an operation. For each of the potential SC solutions, BTO, MTO, ATO, PTO, STO and MTS, the risk that the market fails to deliver on time is low. However, the limitations in operational

capability if it fails are disastrous, or severe. Nevertheless, the IPT may find that operational risk-taking is acceptable and/or necessary, given the costs and commercial risks associated with PTS. The IPT may also find it judicious to use a combination of PTS and operational risk-taking, where a certain percentage of the required supplies are pre-stored to reduce the operational risk.

If increasing market capabilities and reducing operational dependency is unfeasible or unaffordable and operational risk-taking is at an unacceptable level, defence authorities must utilise PTS (Tactic lever 3b, Table 3). However, PTS is associated with extra costs and commercial risk-taking and defence authorities must use it restrictively.

4.8 Step 4d: Selection of supply chain strategies for strategic supplies

For strategic supplies, the PPM is a catalyst for in-depth discussions among all stakeholders prior to any decisions. In addition to staff responsible for segmentation, market and impact analysis, other stakeholders from the SwAF and FMV are required to join an IPT, to resolve legal, commercial, technical and operational issues regarding the interrelatedness of logistics and operational capabilities, including operational, commercial and risk analysis. From the SwAF this includes staff from the operational and military strategic levels, TPS, JFC and Defence Staff. From FMV, this includes the Logistics Division, the Commercial Affairs Division, the Legal Affairs and Security Office and the Governance, Policies and Plans Office.

Immediately after segmentation, the IPT analyses opportunities to reposition the supply item to delivery risk or operational risk supplies, by reducing the impact of failure to deliver on time (Tactics 1a-e, Table 3) or by increasing the probability of delivery on time (Tactics 2a-e, Table 3). If possible, the IPT repositions the supply item to delivery risk supplies (R9, R10 or R11, Figure 2) or operational risk supplies (R12, R13 or R14, Figure 2) and procurement follows in accordance with Step 4b or 4c. If repositioning is impossible, the IPT analyses if operational risk-taking is an option (Tactic lever 3a, Table 3). As part of this analysis, the IPT analyses if they can reduce the level of operational risk-taking by increasing the probability of delivery on time (Tactics 2a-e, Table 3) or by reducing the impact of failure to deliver on time (Tactics 1a-e, Table 3). If possible, the IPT repositions the supply item within the segment (R15, R16, R17, R18, R19 or R20, Figure 2).

If the remaining level of operational risk-taking is acceptable, the responsible authority procures supply items in accordance with the matching, or potentially matching SCSs (Table 2). PTS is a match and ETO is a mismatch for all operational requirements. The potential matches for requirements on availability and preparedness depend on lead-times for different supplies. The potential matches for requirements on sustainability depend on lead-times and consumption patterns for different supplies and on duration and stage of an operation. For each of the potential SC solutions, BTO, MTO, ATO, PTO, STO and MTS, the risk that the market fails to deliver on time ranges from relatively low to high. The limitations in operational capability if it fails ranges from minor to disastrous.

For strategic supplies operational risk-taking is less likely to be acceptable than for other supply segments. If it is at an unacceptable level, defence authorities must utilise PTS (Tactic3b, Table 3). Even if PTS is associated with extra costs

and commercial risk-taking and defence authorities must use it restrictively, for strategic supplies, it may be the only feasible solution.

4.9 Step 5: Repositioning due to changes in the external environment

The staff within the SwAF and FMV who are responsible for the application of the PPM are also responsible for monitoring the development of factors in the external environment, corresponding to the three dimensions in the segmentation model (Figure 1). This responsibility entails conducting operational and commercial analysis, respectively, which may require repositioning in the model. The SwAF and FMV should use existing frameworks from the commercial and military sector to structure the analyses and ensure that all aspects of development are included in the analyses. This means using frameworks such as STEEPLE (social/demographic, technological, economic, environmental, political, legal, ethical), PESTLIED (political, economic, social, technological, legal, international, environmental, demographic), PMESII (political, military, economic, social, infrastructure, information systems) and/or DIME (diplomatic, informational, military, economic), or other of their several derivatives, to assist the analyses. The analysis should include trend analysis, scenario development and sensitivity analysis.

- If the operational requirements change, the responsible staff within the SwAF and FMV must repeat the segmentation from Step 1. The operational requirements may change due to new directives from the political level. Capability development or capability termination may also have effects on the operational requirements.
- If the market's ability to deliver supplies on time changes, the responsible staff within the SwAF and FMV must repeat the segmentation from Step 2. Developments, which may change the market's ability to deliver supplies on time, include new entries into the marketplace, as well as mergers, acquisitions and closures. Changes in production and distribution capacities and localisation may also have an impact on the lead-time and consequently affect the market's ability to deliver supplies on time. Some of these changes may increase the lead-time, whereas others may reduce it.
- If the limitations in the SwAF operational capability if the market does not deliver supplies on time changes, the responsible staff within the SwAF and FMV must repeat the segmentation from Step 2. Changes in operational planning, capability development or capability termination are examples of developments, which may affect the limitations in the operational capability.

If the repetition of the segmentation results in repositioning of a supply item in the model, a new SCS may be the most suitable one. This means that volatility in operational requirements, market capabilities and operational consequences has implications for the length and content of contracts with suppliers. The importance of step 5 must not be underestimated. As an example, a minor change in the marketplace, such as the termination of a localised storage facility, may

turn operational risk supplies into strategic supplies, which could have major operational implications. In addition, simultaneous changes in the dimensions in the two-dimensional model (Figure 1) may transform routine supplies into strategic supplies. The SwAF and FMV must accordingly conduct continuous monitoring and regularly communicate the results of the operational and commercial analyses, so that all stakeholders fully understand the implications of any changes.

5. DISCUSSION

The purpose of this paper is to develop guidance, including tactical levers, for the application of a dynamic PPM for defence procurement. The first research question asks which tactical levers that are suitable for repositioning in a dynamic PPM for defence procurement. Using a workshop with experts in military logistics and defence procurement, the study establishes ten dynamic and two static tactical levers. The dynamic tactical levers are an operationalisation of the application rule “dynamic application”, established by Ekström et al. (2021). To some extent, the findings are in line with previous research, such as Cox (2015), Basnet and Seuring (2016), Hesping and Schiele (2016) and MacCarthy et al. (2016). However, with the exception of Cox (2015), most contributions in the literature do not discuss tactical levers intended for repositioning in a dynamic PPM. Nevertheless, the study finds agreement for the five dynamic tactical levers intended for increasing market capabilities. Regarding dynamic tactical levers for reducing operational dependency, the study finds conformity for two out of five. Since previous research has focused more on the commercial goals of an organisation than the operational goals (Cox, 2015), this lack of confirmation is to be expected. The static tactical lever is labelled risk analysis in this paper, which is in line with Hesping and Schiele (2016). In combination, the proposed dynamic and static tactical levers proposed in this paper demonstrate similarities with elements in the supply chain risk management (SCRM) process, as summarised by Fan and Stevenson (2018). The ten tactics in the dynamic tactical levers correspond to risk mitigation, whereas the two tactics in the static tactical lever correspond to risk acceptance and risk avoidance, respectively.

The second research question asks which guidance for application is required in a PPM for defence procurement to ensure practical relevance. Building on the segmentation model proposed by Ekström et al. (2021), the differentiation strategies proposed by Ekström et al. (2020) and an operationalisation of the application rules established by Ekström et al. (2021), this paper develops such guidance. In general, previous research has contributed with inbound-focused, static PPMs. The proposed guidance answers calls for more comprehensive PPMs (Rezaei and Ortt, 2012) and dynamic PPMs (Cox, 2015). In contrast to previously proposed methodologies, such as the ones proposed by Kraljic (1983), Olsen and Ellram (1997) and Svensson (2004), a significant aspect of this guidance is the repositioning. Similar to the sourcing portfolio analysis (SPA), as described by Cox (2015), this guidance allows users to find a more advantageous position in which to optimise decisions. However, where defence procurement practitioners consider the SPA to be too complex for use in practise (Ekström et al. ,2021), this guidance is based on a PPM that occupies the middle ground between the

simplistic two-by-twos and the more complex SPA. Another important difference between this guidance and existing methodologies is that the ultimate objective is quite different. Extant models, such as Kraljic (1983) and Cox (2015), strive to exploit power positions between the buyer and the supplier, whereas the PPM for defence procurement aim to satisfy the operational requirements of armed forces. This difference is in line with the underlying differences between the private and the public sector. Where the private sector uses production and marketing of goods and services to achieve financial targets, the public sector uses its financial resources to produce public goods and services.

6. CONCLUSIONS, IMPLICATIONS AND FURTHER RESEARCH

6.1 Conclusions and implications

This paper contributes to the PSM and SCM literature in several ways. With the exception of Cox (2015), previous research has mainly contributed with static PPMs. This paper contributes with tactical levers for a dynamic PPM, which enables practitioners to optimise an improved situation (Persson and Håkansson, 2007). This paper also provides guidance for the application of a model developed for the public sector, which is a novelty. Following an initiative taken by Drake et al. (2013) and reinforced by Ekström et al. (2021), this paper integrates theory from PSM and SCM. The paper thus contributes to the literature by providing a PPM that enables holistic SCM (Christopher et al., 2006), in which buyers and suppliers can make SCD decisions based on the operational requirements of the buyers.

In some areas, for example performance-based logistics (PBL), researchers, such as Glas, Hofmann and Eßig (2013), have made significant contributions to the academic knowledge in military logistics and defence procurement in recent years. However, in many other areas, such as sourcing, resiliency and defence SCM, there is an absence of published research in academic journals (Yoho et al., 2013). This paper contributes to the academic knowledge in military logistics and defence procurement by introducing theory from PSM and SCM, to develop tactical levers and guidance for the application of a dynamic PPM for defence procurement.

The paper has implications for managers in both the private and public defence sectors. For managers in the defence industry, it extends the insights provided by Ekström et al. (2020) and further enables them to understand the operational requirements of their military customers. For managers in defence authorities, the paper provides them with guidance regarding how to combine the segmentation model proposed by Ekström et al. (2021) with the differentiation strategies proposed by Ekström et al. (2020). In particular, the guidance includes tactical levers, which will enable defence authorities to dynamically reposition in the segmentation model and find an enhanced position to optimise. The guidance provides the defence industry and defence authorities with an instrument that enables holistic SCM, which will allow SCD beginning with the customer's requirements and moving backwards.

6.2 Future research

Ekström et al. (2021) propose a two-stage segmentation model for defence procurement and Ekström et al. (2020) propose eight SCSs that are acceptable, applicable and sufficient in defence SCD. This paper contributes with the remaining parts of a complete dynamic PPM for defence procurement, tactical levers and guidance for application. As a next step, researchers should combine these contributions to propose a dynamic PPM for defence procurement.

The dynamic and static tactical levers identified in this paper share characteristics with the SCRM process. In future research, it would be interesting to use SCRM theory to develop a framework of dynamic and static tactical levers and test it empirically in the context of dynamic PPMs.

The issues of logistics values and utilities (Mentzer, Rutner and Matsuno, 1997; Rutner and Langley, 2000), value creation (Prahalad and Ramaswamy, 2004) and value co-creation (Vargo, Maglio and Akaka, 2008) relate to the results presented in this paper. It would be interesting to explore these topics further in the public defence context. How can, for example, a military buyer define the value of a safety stock at a supplier and consequently motivate the expense and how can the buyer and the supplier co-create such values? A related issue that would be interesting to investigate is how PBL relates to the PPM for defence procurement. Perhaps researchers should expand the framework to integrate performance-based contracts. This also relates to the wider issue of buyer-supplier relationships. In its present form, the guidance for the application of a dynamic PPM for defence procurement does not include such relationships. As a logical next step, researchers should develop the methodology to include recommendations regarding buyer-supplier relationships.

Industry 4.0 and emerging technologies, such as additive manufacturing (AM), or 3D printing, will inevitably have consequences for defence SCD. Industry 4.0 marks the fourth industrial revolution, enabled by the introduction of the Internet-of-things (IoT) into manufacturing (Tjahjono, Esplugues, Ares and Pelaez, 2017). AM enables manufacturing all around the world (den Boer, Lambrechts and Krikke, 2020) and positioning manufacturing closer to the end-user will potentially reduce lead-times and logistics costs (Durão, Christ, Zancul anderl and Schützer, 2017). It would be interesting to investigate the applicability and consequences for defence SCs. How can, for instance, lead-times in defence SCs be reduced by the introduction of IoT and 3D printing? A pertinent question is also, to what extent is implementation possible, given the classified nature of information in the military sphere?

This paper derives its results from a study in the Swedish defence context. To determine generalisability, additional studies are required. This paper suggests that researchers conduct studies with other methods and stakeholders, in other contexts, including different national perspectives. In particular, this paper invites researchers to test the PPM for defence procurement in other defence settings.

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Peer reviewed article

A review of augmented reality applications for ship bridges

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Abstract

We present a state-of-the-art analysis of Augmented Reality (AR) applications for ship bridge operation. We compiled and reviewed what type of use cases were published, what type of maritime applications have been adapted to AR, how they were prototyped and evaluated and what type of technology was used. We also reviewed the user interaction mechanisms, information display and adaptation to maritime environmental conditions.

Our analysis shows that although there are many examples of AR applications in ship bridges, there is still much work that needs to be done before these solutions can be suitably adapted to commercial settings. In addition, we argue there is a need to develop design requirements and regulations that can guide the safe development of AR.

Keywords: Augmented reality, user interface design, ship bridge applications

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1 DESIGNING MARITIME AR USER INTERFACES

Augmented Reality (AR) technologies superimpose digital information over the physical world (1); this can be implemented with head-mounted displays, directly on (or reflected by) glass surfaces or rendered on video images on screens (2). Multiple authors argue that AR may benefit ship operation by improving situational awareness, reducing head-down time (e.g. 3, 4, 5, 6). However, even though many use cases of AR for ship bridges which have been proposed (e.g. 7, 8), it has not been widely adopted for use on commercial ships. This may, however, change as technology develops, becoming better suited to maritime needs.

When wearing a head-mounted display (HMD) AR headset while engaging with operational tasks on a ship, users may be able to access and deal with information that is relevant to their tasks in a new way. For example, for complex navigation tasks such as ice navigation (Fig. 1), AR enables the user to access speed, heading

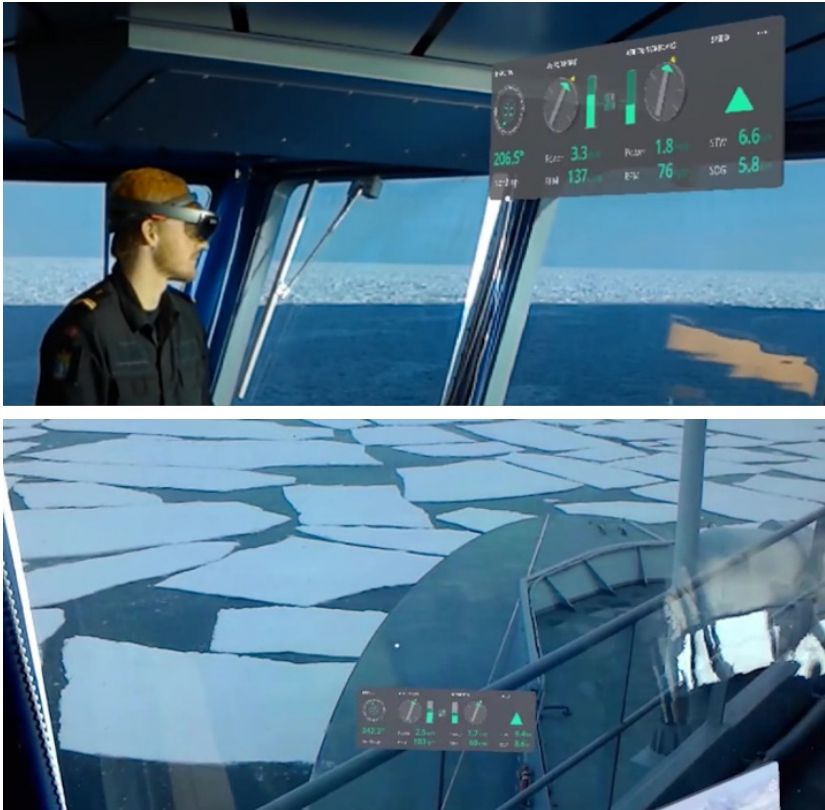


Fig. 1. Experiments with HMD for ice navigation support at Svalbard, showing different alternatives for positioning and design of AR user interfaces (20). Credit: Ocean industries concept lab (OICL), The Oslo School of Architecture and Design

and power information while looking out for ice movements. Without AR, the user has to look down at the navigation instruments to obtain the same information. This indicates that AR may enable avoidance of loss of eye contact with important information outside the ship. In the case of a heads-up display (HUD), augmented information is displayed on a fixed, transparent surface, that does not follow the movements of the user. HUDs have been used in cases where the user can work from a fixed position, for instance plane pilots, or car drivers. In ship bridges there is an expectation that users may move freely around the bridge, hence HMDs have gathered more research attention.

We present a state-of-the-art review of the use of AR in maritime user interfaces, specifically focusing on applications for ship bridges. Our analysis, however, extends previous state-of-the-art reviews (e.g. 9, 10, 11) placing a particular focus on user interface design and on ship bridge applications.

Until now, AR has been regarded as a standalone device with highly specialized functionality. However, the current and upcoming versions of AR hardware can potentially render any information and even replace screens. We argue that since AR uses the entire world as a canvas, it should not be considered as a single-purpose system. Instead, we assert that it is useful when addressing AR as an extension of any ship bridge system. However, in seeing AR as an extension of the many current ship bridge systems, there is a risk that usability problems found in existing ship bridges are repeated and reinforced. This may include inconsistent design, cluttered interfaces and information overload (12, 13). To avoid these problems, we aim to lay the foundation for a generic integration system that can use AR applications and enable system vendors to deliver applications that can safely share the real world as an information space. The current review is part of the SEDNA project, a study that aims to develop this type of generic integration system for maritime AR (14). Because of this, the present review emphasizes topics related to user interface design.

2 AR REVIEW

A two-steps approach to finding references for the review was applied. First, we targeted journals and conference proceedings that were likely to contain references to AR use cases. Second, we carried out an open search in Google and Google Scholar, where we looked for additional references, grey literature, as well as patents and industrial products. In both steps, we used the same set of search keywords: augmented reality, AR, heads-up display, HUD, head-mounted display, HMD, mixed reality, MR, extended reality and XR. The keywords were selected to cover a wide array of technical terms related to AR, for instance “mixed reality” and “extended reality;” abbreviated MR and XR respectively. “Mixed reality” refers to “the merging of real and virtual worlds,” without a specific focus upon how it is technologically achieved (1, p2.). “Extended reality” is a more recent term used to designate both augmented reality and virtual reality technologies.

In the first step, the following source material was consulted: proceedings of the Conference on Computer Applications and Information Technology in the Maritime Industries (COMPIT), proceedings of the International Marine Design Conference (IMDC), transactions of the *International Journal of Marine Design* (IJMD) and the Journal of Applied Ergonomics. For each article we found, we

looked for references that pointed to other potential uses and consulted these references as well. This extended our initial search for additional conferences and journals.

To review the collected source material, a database that systematizes the source material was built. The database contains the specific use case presented, what existing applications had been adapted to AR, the technology used (both hardware and software), how the technology was tested, and how the use case was conducted as well as the findings.

The database also charts information about the user interfaces of each use case. This includes how information is displayed in the world, how users interact with the AR systems (single and multiuser, gesture, vocal command etc.), and how the system might address the specific challenges of the maritime context (ship motions, changing light conditions). Each specific aspect of the user interaction and system functionalities is explained in more details in the subsequent sections. All the tables containing data from the review are placed in the Appendix at the end of this article.

2.1 Identified source material

We identified a total of 40 publications that present the use cases of AR in maritime workplaces (Fig. 2). We sorted the types of use cases into two main categories: navigation aid and bridge systems (19 out of 40 references) and other types of use cases (21 out of 40).

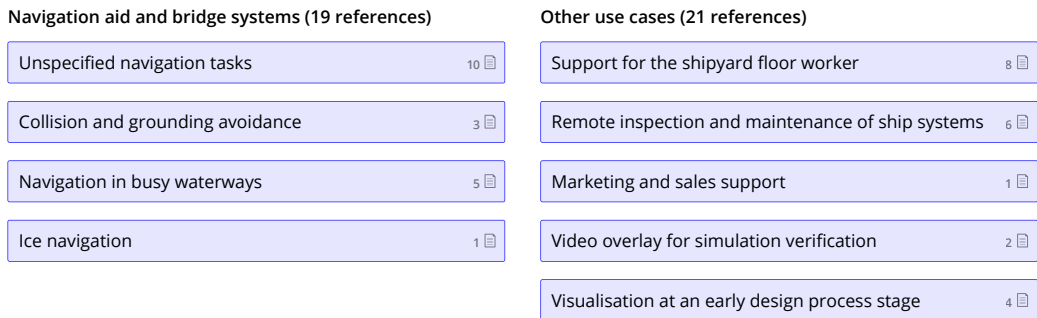


Fig. 2. Types of AR use cases identified, and number of references per type of use case. The review focuses only on navigation aid and bridge system use cases (left).

We identified four types of use cases in the category of navigation aid and bridge systems, summarized in Table 1 in Appendix. *Unspecified navigation tasks* refer to cases where AR is presented as useful for navigation, although no specific example is given. We found 10 references of this type, with for example Erlandsson and Jansson (27) discussing the potential of using AR to support the operation of High-speed Crafts, or Walther et al. (34) discussing the potential of using AR to support

shore-side assistance of remote-controlled tugs. *Collision and grounding avoidance* refer to cases where AR is applied to navigation support, with the aim to avoid collision and grounding outside harbor areas and other dense traffic waterways. We found three references of this type, with for example Procee et al. (4) presenting a concept for computing and visualizing in AR potential threats of collision. *Navigation in busy waterways* refers to similar cases, although with a specific focus on harbor areas and other dense traffic waterways. We found five references of this type, with for example Oh et al. (36) presenting a concept for visualizing the name, course and speed of surrounding ships in the field of view of the navigator. Finally, *Ice navigation* yielded only one reference, with Frydenberg et al. (20) presenting concepts for supporting the lookout work of navigators in ice waters.

In the other cases (Table 2 in Appendix) not related to navigation aid and bridge systems, we identified the following types of use cases: support for the shipyard floor worker, remote inspection and maintenance of ship systems, marketing and sales support, video overlay for simulation verification and visualization at an early design process stage.

We focused our analysis only on the navigation aid and bridge system cases and did not review in detail the other types of use cases. As a result, in the rest of the current article, only the references presented in Table 1 (in Appendix) are further analyzed. One reference (11) includes several use cases, hence it appears several times in Tables 1 and 2. When several references presented the same use case, only the reference that describes the use case in the most comprehensive way was included. Some references were excluded for this reason (15, 16, 17, 18, 19).

To give the reader an idea over the type of use case encountered, we redrew a selection of graphical user interfaces (GUIs) presented in the reviewed references (Fig. 3). We used a systematic representation of each GUI to ease the reading and comparison: the horizon line is always placed at the middle of the figure, a black-grey-white palette is used, and the same font is used for all the cases. Whenever possible we reproduced the actual content of the reviewed GUI, although most of the time we had to interpret the content, because of poor readability of the GUI figures in the original references, and lack of detailed textual explanations. As such the content of Fig. 3 is not meant to be accurate, but only representative, and the reader is kindly referred to each individual reference for more details about the reviewed use cases. A first look at the different redrawn GUIs redrawn in Fig. 3 shows the variety of information rendered in AR, and the variety of ways to render it in AR. The differences across AR use cases are analyzed in further detail in the subsequent sections.

As a side note, one reference in the source material was written by researchers in the research group of the current article's authors (20).

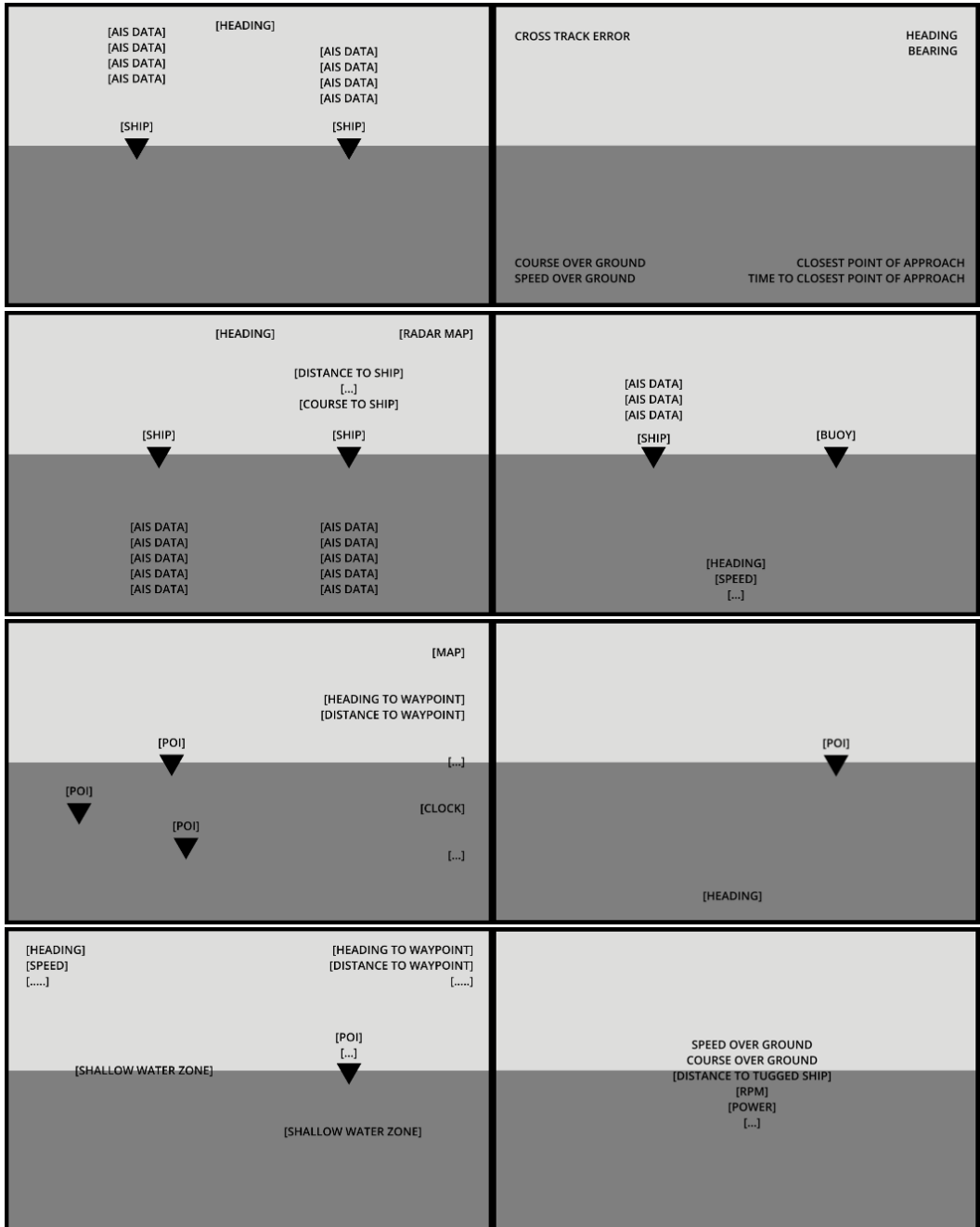


Fig. 3. Examples of GUIs from reviewed AR use cases, systematically redrawn. Left column, from top to bottom: (5), (7), (17), (19); right column from top to bottom: (6), (8), (28), (34). Key: [AAA]: interpreted content; [...]: unable to interpret content; AAA: actual content; POI: Point of Interest.

2.2 Maritime functions rendered in AR

Although we envision that any function may be mediated through AR, certain functions would lend more naturally to an AR interface. Fig. 4 shows an example of maritime functions rendered in AR onboard a coast guard vessel, when the user is wearing a HMD and looking aft.



Fig. 4. Maritime functions rendered in AR, from left to right: heading information from a compass, power information about azipod thrusters, and speed. Credit: OICL.

We reviewed the selected references and looked for the following types of functionalities, using the following assumptions:

- Navigation functionalities related to dealing with ship traffic surrounding the vessel are commonly associated with Automatic Identification System (AIS) applications and include some indication of the position, name and compass reading of other ships in the area. We refer to this type of functionality as 'ship traffic.' For example, Rolls Royce (8) presented a concept where the name, speed and compass reading of surrounding vessels are rendered in AR to support navigation in busy waterways.
- Maneuvering functionalities are commonly associated with conning applications and include some indication of heading, rudder angle, speed, and power (or load) for different engines. For example, Holder and Pecota (30) presented a concept where heading and speed are rendered in AR to help with low visibility conditions.
- Charting functionalities are commonly associated with ECDIS applications and include some indication of heading, GPS position and all other information present on navigation charts. For example, Morgère et. al (32) presented a concept for generating maps with augmented information such as 3D view and highlighting of buoys.

- Depth monitoring functionalities are commonly associated with echo/depth sounders and sonar applications and include some indication of water depth. For example, Oh et. al (36) presented a concept where the depth in the immediate path of the ship is rendered in AR, together with information about speed, heading, and more.
- Radar functionalities are commonly associated with radar applications and include some indication of objects present in the surroundings of the ship that can be identified with radar technology. Mitsui O.S.K lines (7) presented a concept where a mini radar map is added to the top right corner of the user's field of view in AR, alongside with information about surrounding ships' position, heading and speed.
- For functionalities not covered by the descriptions above, we include an 'other' category.

Table 3 (in Appendix) gives an overview of recurring functions that have been adapted to AR in the source material which we have reviewed. The reviewed data are based on our interpretation of the textual and visual material present in the analyzed publications. The visual material consists of screenshots of GUIs and data flowcharts showing the data inputs and outputs of the proposed AR application. In most references, the data flowcharts indicate a non-exhaustive list of input data, explaining that the AR application was designed with the possibility of including additional types of data in future iterations. As a result, the content of the table needs to be read as indicative information only, and the provided list is not exhaustive.

The examples in Table 3 show that there is a wide range of maritime-related functions considered in the studies when it comes to mediation through AR. In several references, several functions are combined into a single AR application. Charting functionalities are the most recurring, depth monitoring the least. Maneuvering and ship traffic functionalities occur in respectively 10 and 9 references out of a total of 19 references. Radar functionalities occur in 7 references. In the 'other' functionalities, we found, for example, functionalities dealing with the display of real-time video feeds from cameras outside the bridge, displays from the engine control room and displays related to the vessel traffic service (VTS).

In general, the results show that AR may offer an extensive set of functions to end users. However, many functions sharing AR space may lead to information overload and a cluttered outside view. Because the functionality is offered by multiple industry actors, there is also a need to understand how they can share AR space, how to support new functions and how to avoid an inconsistent design of the interfaces on a potentially shared AR platform. This is a problem well-known within current multivendor ship bridges, where a lacking integration of user interfaces is a central cause of suboptimal maritime workplaces (13). Given the many types of applications that may be rendered in AR, AR will meet similar problems.

2.3 State of advancement for AR system

Although there are many use cases of AR in the maritime literature, there is a lack of commercially proven systems. Table 4 (in Appendix) gives an indication of the state of advancement of each reviewed case. We looked for information specifying:

- if a prototype of the AR application had been built
- if the prototype had been tested in a simulator, and/or onboard a ship
- the type of users involved in user testing
- the type of methods employed in user testing

In some cases, we were not able to distinguish if a prototype was built but not reported, or if no prototype was built at all. Similarly, in some cases we were not able to distinguish if a user test was carried out, but not reported, or if no test was carried out at all. In the overview table (Table 4), we used 'Not specified' in such cases, meaning that no sufficient information is reported in the consulted reference.

The data in Table 4 show that most of the concepts (16 out of 19) present the use case through a prototype. Despite this, the testing or evaluation of the use case are often not specified (13 out of 19). When a test or evaluation is specified, it is a fair distribution between tests in a simulator (six cases) and tests onboard ships (four cases). In two instances, Frydenberg et al. and Oh et al. (20, 36), the tests are carried out on both simulators and onboard the ship. Tests done in simulators are mostly carried out in traditional simulators, except from Frydenberg et al. (20) who used virtual reality (VR) to test AR concepts.

The results show that there are many experiments of early phase AR use in the maritime sector, but there is a significant lack of rigorous testing. One potential reason for this is that both the hardware and software are in very early development, so rigorous testing in real cases is challenging. We have discovered this in our own work, where for instance, the Hololens hardware has significant problems in moving water. However, by bringing a prototype to sea, we understood much more about the requirements of designing AR for ships bridges, even though the prototype was not robust enough to support all maritime conditions (20).

Our own experiences from field studies on ships (21,22) suggest that the maritime workplace poses significant contextual challenges for end users that may greatly affect the use of AR. We argue that in moving towards AR for the maritime sector and with rapidly improving technology, research should further



Fig. 5. Screenshot from a VR-based simulator used to prototype and test AR applications. Credit: OICL.

emphasize developing prototypes testable in real maritime conditions. Traditional and VR-based simulator testing is useful since many variables and parameters may easily be changed in the simulator. A limitation with traditional simulators based on projectors and screens holds that they will not be able to provide a realistic perspective for connecting AR graphics to the outside world. VR-based simulators do not have this type of problem (Fig. 5). However, because of the shifting and demanding context and operations at sea, we suggest that maritime AR needs to be developed in close relation to real sea trials. An iterative testing procedure could be based on combining testing in simulators and at sea.

2.4 Information rendition in AR space

In seeing AR as a shared resource across bridge systems, we need to address how AR renders information in the environment. In the SEDNA project (14), we developed a simplified model of how to show information in the world based on the requirements gathered in the project (Fig. 6 and Fig. 7). The model includes the following information objects:

- *App display*. This component allows the display of full applications in the AR view. Examples: ECDIS and radar.
- *Widget display*. This allows the display of smaller stackable information containers. Examples: compass and speed indicator.
- *Annotation*. These are small information containers connected to Points Of Interest (POIs) in the world. Example: information about surrounding vessels and objects.
- *Ocean overlay*. This allows the display of information directly on the ocean. It typically shows routes and no-go zones.
- *AR map*. This is a flat map interface placed above the horizon, able to display any map-related information.



Fig. 6. Types of information components developed in the SEDNA project (14) and used to analyse the AR use cases in the current review article.

In Table 5 (in Appendix), we have charted whether the use cases employ similar formats. As in the previous tables, the contents of Table 5 are based on the textual and visual descriptions of the applications in the reviewed references. As such, to a large extent, the contents are interpreted based on the definitions of the information objects given above.

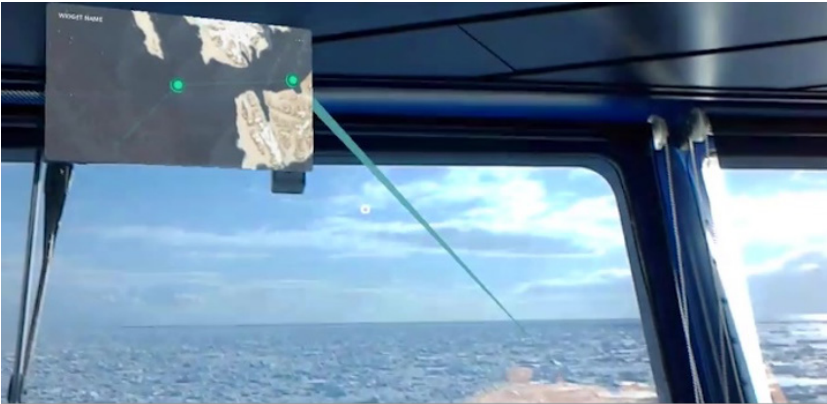
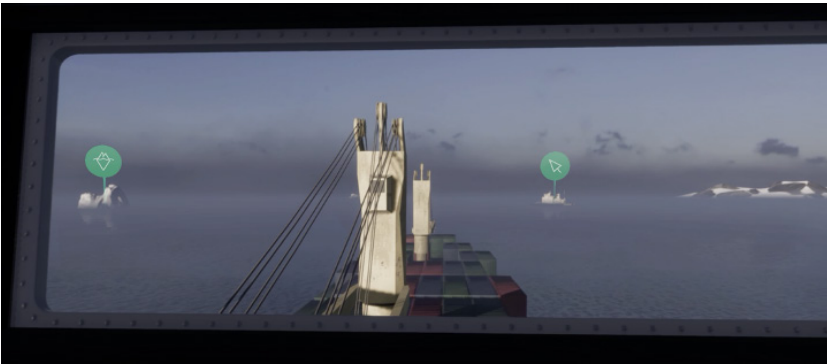


Fig. 7. Examples of information components developed in the SEDNA project (14). From top: Widget display with data from a wind sensor, Annotation connected to Points of Interests outside the ship (Iceberg and vessel passing by), Map linking a point in the map with a position in the world with information. (All examples shown are explorative concept and prototypes).

The data in Table 5 show that Full app display and AR map are the least used ways to render information, used respectively in only two and three references. Displayed apps are conning (17) and unspecified bridge systems (34). The AR maps are navigational maps in 3D (17), positions of other vessels in the area of the considered ship (7) and a specific type of display called a ‘velocity obstacles diagram’ (4), which combines the position, heading and speed of surrounding vessels into one type of information display. Widget, annotation and ocean overlay are the most common way to display information, used respectively in fifteen, fifteen and thirteen references. They are often used in combination, with, for example, information about surrounding vessels displayed as annotation, combined with a compass widget in the top or bottom part of the field of view and a conning widget displayed in the corners of the field of view.

The analysis shows that many of the AR applications rely on similar types of visual representations. However, we did not observe any consistent use of specific text formatting, colour palettes, line types, geometry types, or icon formatting across the references. Because of this, we argue that there is a need to develop generic models for how to render most applications into a common integration system.

2.5 Adaptation to maritime context

AR interfaces for maritime usage need to consider a range of contextual challenges specific to the maritime sector. Aspects such as ship motion, maritime operations, fatigue, seasickness, contrast and light conditions all affect user interface design. In our review, we found only four references that mention ways to deal with maritime environmental challenges. These include the following:

- Minimum interface luminosity for use of AR with HMD (32)
- Using AR in different light conditions (27)
- Ability for the user to adjust the data display colour (36)
- Position of user, projection on different surfaces, adaptation to different lighting contexts (20)

The analysis shows that most of the current use cases do not significantly address how to adapt AR to maritime contexts. This is an important limitation of current work, and we suggest a greater emphasis in this area to make sure AR works in most maritime contexts and conditions. In our own work, we have found that interface luminosity and contrast are challenging to deal with in changing light conditions. We have experimented with different color palettes for day, night, sunset and sunrise conditions. We also have developed simple Do-It-Yourself protections to wear on top of the HMD to block some light in full sunlight conditions.

2.6 Interaction with AR HMDs

Interaction with head-mounted AR interfaces in other domains often use advanced multimodal interactions such as gaze, voice and gestures. In AR, gaze may be used similarly to a mouse, to move a pointer to a specific location. Voice in

AR may be used similarly to give instructions to a digital personal assistant like Siri or Alexa, as well as giving GUI specific instructions such as zooming in/out, displaying or removing the display of parts of a GUI, or interactions similar to a mouse click. Gesture in AR is inspired from gestures now common in touch screens, although the gestures may be using the end user's hands and arms, instead of just fingers. It is currently uncertain how all these types of interactions may be applied in different maritime use contexts. In analyzing the current use cases, we found only four references that mention user interaction mechanisms. Hareide and Porathe (29) refer to AR information that may be always displayed in the user's field of view, and information that will be displayed only when the user is looking in specific directions. Erlandsson and Jansson (27) briefly explore a similar concept. Walther et al (34) show a concept where the user may perform zooms in and out of the AR application using gestures. Frydenberg et al (20) present preliminary concepts about how the user's location may be used to define requirements for how to display information in AR, given the fact that the surfaces upon which AR may be displayed (for example bridge wall or bridge window) depend on the user's location.

Maritime work conditions are very diverse, and users move between workstations, operate other equipment, suffer from fatigue, and must work in a moving environment (22). It is currently unknown how these conditions affect the design of AR interaction, and the works we reviewed have not addressed these issues in any significant way. The use cases tend to treat AR systems as information displays, without addressing how to enter data or manage AR-mediated information.

2.7 AR technologies in use

The reviewed use cases have been comprehended as a wide range of technologies. From studying the application of hardware and software technologies, contextual information has been added to use cases. Table 6 (in Appendix) lists the specified hardware and software of the AR technologies for each use case. More recent publications tend to use off-the-shelf technology, such as Microsoft HoloLens (20, 29), Google glass 1.0 (37) and Google glass 2.0 (6). Earlier publications often consist of custom-built technology, which presents several limitations and might have prevented further exploration of AR use cases.

As explained in the 'state of advancement section', the use of not off the shelf type technology implies the use of custom-built technology both for hardware and software, which limits the extent to which the use of the technology could be assessed because these studies focus on whether the hardware worked instead of what the users might be able to do with it. As a possible consequence of the complexity of maintaining custom-built software libraries, several software libraries that are presented for authoring in AR are apparently not in use anymore, e.g. the Instant reality framework (23). None of the reviewed material referred to open source AR libraries such as AR ToolkitX (57) or OpenXR (58).

The data in Table 6 show that the technologies used in the various studies underline the state of AR technologies in general. Many of the systems relied on technologies that are now obsolete. It is likely that forthcoming AR hardware will solve many of the problems with current generation technologies. In addition, it

is likely that current and forthcoming platforms for AR software will also simplify the development of AR solutions. As a result, we argue that research in future AR technology should increase its focus on design principles.

3 DISCUSSION

Based on the reviewed use cases, we argue that AR might play an important role in the future of maritime workplaces. However, its application depends on a relationship between the increasingly more capable AR technologies and AR's usefulness in different use cases. As technology improves, it is likely to become useful to a wider range of maritime operations. We foresee a similar development as mobile phones, where new usages appeared with the development of technology: reading emails, browsing internet, playing games or having a personal assistant. As shown in Fig. 8, with current technology such as Hololens, we are only at the beginning of the use area / technology development curve, and new usages will most likely become more common with technology development.

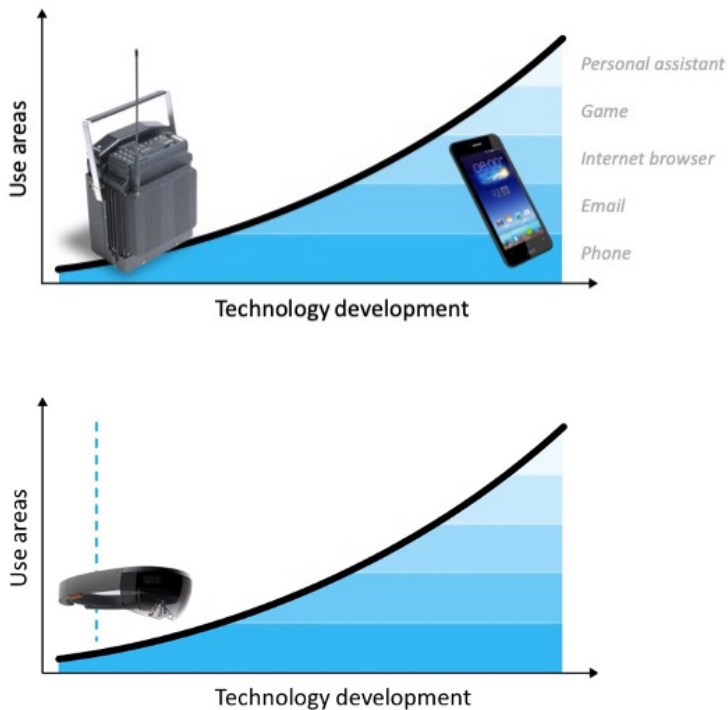


Fig. 8. Use areas vs. technology development. We foresee a similar evolution for AR (bot-tom) as for mobile phones (top), where the types of usages expanded together with technological improvements. We are currently only at the beginning of this pattern (blue dotted line).

There is no reason to believe that the pace of AR development will slow down in the years ahead (24). We suggest that research in maritime AR should increase and emphasize the development of frameworks that can extend into future technology generations. To do so, we suggest an increased focus on the development of design principles and guidelines that can support maritime AR development. Grabowski (3) presents an example of such work by providing a list of research questions that are important to consider when dealing with AR. Grabowski embeds the research questions in a conceptual framework that links technology features with task complexity and topics for evaluation of AR implementations, including the following: perceived ease of use, perceived usefulness, decision performance and decision processes.

There is a need to describe the categories of maritime use cases that may be supported by AR, and in our review, we have found that there are several recurring use cases. However, the use cases have not been described in detail in ways that can be used as requirements in the design of new AR applications. Better descriptions of the use cases might help the development of improved AR systems. For instance, Vu et al. (25) present a survey about how frequently seafarers use different functions and information on integration navigation systems when performing navigation tasks. This type of research is useful for AR, and it can be extended to include evaluations of what functions may benefit from AR visualization. Procee et al. (4) propose a methodology (cognitive work analysis) to identify what functions and tasks might be relevant to bring to AR.

Increased focus has been placed on AR as a platform for multiple ship systems. As mentioned earlier, ship bridges are usually made up of many systems. If we see AR as an extension of a ship's bridge, it is necessary to see the AR system as a shared resource for any application. Similarly, Rowen (6) concludes that future research should consider AR in combination with all the other systems and interfaces present on a bridge. However, to fulfil this vision, there is a need to develop an integrated platform for AR applications. Our review found no available design guidelines for maritime AR interfaces. Nordby et al. (13) argue for the need for design processes that cater to consistency across medias, platforms, and vendors. Their argumentation is introduced for the context of the bridge as a workplace, and the development of AR applications is an example of the need to deal with consistency.

Finally, many of the problems related to using AR at sea are generic and apply to any maritime function. Indeed, issues such as contrast, readability and anchoring information in the world can be applied to any maritime system. Because of this, we contend there is a need to develop interaction and user interface principles specifically for a maritime context (22, 26). In doing so, we can develop a robust AR infrastructure that will simplify the development of AR functions, achieving safer maritime operations.

4 CONCLUSION

AR may be a significant technology that could enhance maritime safety by strengthening operators' situational awareness. However, to take advantage of the technology, there is a need to adapt it to the maritime user's context and needs. Our analysis has shown that although there are many examples of maritime AR use

cases, it is still in its infancy. Our review found few use cases with clearly specified user needs and use scenarios, concept testing or evaluation, demonstrating a limited focus on human-centred design perspectives of designing AR interfaces.

Based on our review, we suggest that because this is rapidly developing technology, more research should address user-centred design of AR systems. This includes design requirements, design principles and design guidelines. Also, because future AR systems will work in combination with existing, non-AR systems, it is necessary to understand AR as an extension of current bridge systems. Further, given the existing usability problems on ship bridges, research must lay the ground for future development to avoid the current problems related to multivendor ship bridges related to inconsistent design and a lack of user interface integration. We refer to ongoing development of a design framework for AR applications expanding the OpenBridge design system to address these issues (59).

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6 APPENDIX

Table 1. Overview of references for navigation aid and bridge systems

Ref.	Title	Type of use case	Tech.
(27)	Augmented reality as a navigation aid for the manoeuvring of high-speed crafts	Unspecified navigation tasks	HUD
(28)	AR binocular: Augmented reality system for nautical navigation	Unspecified navigation tasks	Binocular
(29)	Maritime augmented reality	Unspecified navigation tasks	HMD
(30)	Maritime head-up display: A preliminary evaluation	Unspecified navigation tasks	HUD
(17)	An experimental augmented reality platform for assisted maritime navigation	Unspecified navigation tasks	HUD
(31)	Real-time infinite horizon tracking with data fusion for augmented reality in a maritime operations context	Unspecified navigation tasks	HUD
(32)	Electronic navigational chart generator for a marine mobile augmented reality system	Unspecified navigation tasks	HUD
(33)	Marine navigation binoculars with virtual display superimposing real world image	Unspecified navigation tasks	Binocular
(34)	Shore-side assistance for remote-controlled tugs	Unspecified navigation tasks	HMD
(35)	Augmented reality for precision navigation: Enhancing performance in high-stress operations	Unspecified navigation tasks	HUD
(7)	AR voyage information display system	Collision and grounding avoidance	HUD
(5)	Augmented reality as part of a man-machine interface in e-navigation	Collision and grounding avoidance	HMD

(4)	Using augmented reality to improve collision avoidance and resolution	Collision and grounding avoidance	HMD
(36)	Advanced navigation aids system based on augmented reality	Navigation in busy waterways	HUD
(37)	Smart glasses to support maritime pilots in harbor maneuvers	Navigation in busy waterways	HMD
(8)	Rolls Royce Intelligent Awareness System for vessels	Navigation in busy waterways	HUD
(6)	Impacts of wearable augmented reality displays on operator performance, situation awareness, and communication in safety-critical systems	Navigation in busy waterways	HMD
(38)	Applying the navigation brain system to inland ferries	Navigation in busy waterways	HUD
(20)	Exploring designs of augmented reality systems for ship bridges in arctic waters	Ice navigation	HMD

Table 2. Overview of references for other types of use cases

Ref.	Title	Type of use case
(39)	Simulations, virtual and augmented reality technologies for ship life-cycle engineering	Support to shipyard floor worker
(40)	Augmented reality for the retrofit of ships	Support to shipyard floor worker
(41)	Augmented reality supported information gathering in one-of-a-kind production	Support to shipyard floor worker
(42)	Augmented reality assistance for outfitting works in shipbuilding	Support to shipyard floor worker
(43)	Introduction of AR applications for shop floor in shipbuilding	Support to shipyard floor worker
(44)	Application of AR technologies to sheet metal forming in shipbuilding	Support to shipyard floor worker
(45)	Augmented reality pipe layout planning in the shipbuilding industry	Support to shipyard floor worker
(11)	Maritime applications of augmented reality-experiences and challenges	Support to shipyard floor worker

(46)	Content first: A concept for industrial augmented reality maintenance applications using mobile devices	Remote inspection and maintenance
(47)	Benefits achieved by applying augmented reality technology in the marine industry	Remote inspection and maintenance
(48)	AR-based ship design information supporting system for pipe maintenance	Remote inspection and maintenance
(49)	Modular authoring of augmented reality-based service instructions	Remote inspection and maintenance
(50)	AR spatial intelligence	Remote inspection and maintenance
(51)	Wärtsilä successfully tests remote guidance service capabilities	Remote inspection and maintenance
(11)	Maritime applications of augmented reality – Experiences and challenges	Marketing and sales support
(52)	Evaluating evacuation simulation results in a virtual reality environment	Video overlay for simulation verification
(11)	Maritime applications of augmented reality – Experiences and challenges	Video overlay for simulation verification
(53)	Interaction and ergonomics issues in immersive design review environments	Visualisation at early design process stage
(54)	Efficient use of virtual and mixed reality in the conceptual design of maritime workplaces	Visualisation at early design process stage
(55)	Potential benefits of augmented reality in the smart ship	Visualisation at early design process stage
(56)	Virtual and augmented reality for the maritime sector – Applications and requirements	Visualisation at early design process stage

Table 3. Maritime functions rendered in AR.

Reference	Ship Traffic	Manoeuvring	Charting	Depth monitoring	Radar	Other
(37)	1		1	1	1	
(6)		1				1
(36)	1		1	1		1
(8)	1		1		1	
(38)	1		1	1	1	1
(5)		1	1			1
(4)		1	1		1	
(7)	1		1		1	1
(20)	1	1	1			
(33)		1	1			
(28)						1
(27)		1				
(34)	1	1				
(29)		1	1	1		
(35)	1		1		1	1
(30)		1				
(17)			1		1	1
(31)			1			
(32)	1	1	1			
Total	9	10	15	4	7	8

Table 4. State of advancement

Code	Prototype built	Tested in simulator	Tested onboard ship If yes: specify	Users (in test)	Test method (surveys, etc)
(29)	Not specified	Not specified	Not specified	Not specified	Not specified
(7)	Not specified	Not specified	Not specified	Not specified	Not specified
(8)	Not specified	Not specified	Not specified	Not specified	Not specified
(27)	YES	YES	Not specified	4 male mariners with 20–30 years of experience	Learning phase, then control, then four different scenarios; measuring visual focus and heads down time
(28)	YES	Not specified	Not specified	Not specified	Not specified
(30)	YES	YES	Not specified	20+ students	Survey, with Likert-scale items and open questions
(17)	YES	Not specified	Not specified	Not specified	Not specified
(31)	YES	Not specified	Not specified	Not specified	Not specified
(32)	YES	Not specified	Not specified	Not specified	Not specified
(35)	YES	Not specified	Amphibious vehicle, on a beach (both land and sea)	Not specified	Comparing planned course with actual course with or without support of AR
(5)	YES	YES	Not specified	Not specified	Not specified
(4)	YES	Not specified	Not specified	Not specified	Not specified
(36)	YES	YES	Harbour entry/ departure	20 experienced ship officers	User surveys and one-on-one interviews
(37)	YES	Not specified	Not specified	Not specified	Interviews
(38)	YES	Not specified	Three inland river ferries	Not specified	Not specified

(20)	YES	VR simulator	Coast guard vessel in Ice navigation	Coast guard officers	Rapid prototyping and qualitative user testing in VR lab and/or field study
(33)	YES	Not specified	Not specified	Not specified	Not specified
(34)	Virtual prototype in Unity)	Not specified	Not specified	Not specified	Not specified
(6)	YES	30 min harbour entry/ departure scenarios	Not specified	Over 200 participants	Extensive set of qualitative and quantitative data before, during and after each transit scenario

Table 5. Rendering of information in AR.

Code	App display	Widget display	Annotation	Ocean overlay	AR map
(27)				1	
(28)		1	1		
(29)		1	1		
(30)			1	1	
(17)	1	1	1	1	1
(31)				1	
(32)		1			
(33)		1	1		
(34)	1	1	1	1	
(35)		1		1	
(7)		1	1	1	1
(5)		1	1	1	
(4)		1	1	1	1
(36)		1	1	1	
(37)		1	1	1	
(8)		1	1		
(6)			1		
(38)		1	1	1	
(20)		1	1	1	
Total	2	15	15	13	3

Table 6. Hardware and software used

Code	Technology: Hardware	Technology: Software
(27)	Not specified	Custom built
(28)	Augmentation camera, Fisheye camera, accelerometer sensor, binocular OLED display	Custom built
(29)	Head-up display by Afterguard; Hololens	Not specified
(30)	Projection on simulator screen	Custom built
(17)	LookSea system by Technology Systems Inc.	Custom built
(31)	Not specified - requires a video feed	OpenCV library (Intel Open Source Computer Vision)
(32)	Modified MG1 model from Laster	Custom built/presented in the publication
(33)	Custom built	Custom built
(34)	Not specified	Not specified
(35)	Custom built	Custom built
(7)	Not specified	Not specified
(5)	Not specified	Not specified
(4)	Not specified	Not specified
(36)	PTZ (Pan/Tilt/Zoom) camera, AHRS (Altitude and Heading Reference System), NMEA Combiner, and user console with an additional joystick device for camera control	Software system composed of a data manager module, user interface module, registration module, and augmented image rendering module (running with Unity)
(37)	'Smart Glasses' - Google Glass, Vuzix M100, or the EPSON BT200	Not specified
(8)	Not specified	Fusing sensor data with intelligent software for bridge systems
(6)	Google glass version 2 (2016)	GlassNav software developed at Le Moyne College
(38)	Not specified	Not specified
(20)	Hololens	Hololens and Openbridge libraries

Peer reviewed article

Seapower theory and military history; a close but troublesome interrelationship

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INTRODUCTION

By careful collation of past events it becomes clear that certain lines of conduct tend normally to produce certain effects; that wars tends to take certain forms each with a marked idiosyncrasy; that these forms are normally related to the object of the war and to its value to one or both belligerents..¹

Sir Julian S Corbett, prominent naval historian and seapower theorist

Seapower theory is intended to explain the nature, character, characteristics, and conduct of war in the maritime domain. Theory about war and the maritime, and about naval warfare, certainly shares some basic traits with the physical sciences in the use of observation, description, measurement, and structured analysis supporting causal inferences or explanatory hypotheses. However, it also remains distinct from the physical sciences in significant ways, most notably in the absence of controlled, replicable experimentation as means of validating theory. For this and as warfare largely is a social activity, the conceptual foundations of the field reside more appropriately in the realm of the social sciences.² The nature of information, particularly pertaining to environments where data is dispersed, tacitly understood, or in forms resistant to detection, collection, and analysis, thus rendering it too subjective to be a basis for scientifically valid conclusions. War and warfare are nothing but such environments, i.e. complex human interaction where information always is fraught with uncertainty. Moreover, theory formation in such an environment is a function of information availability.³ Therefore, seapower theory cannot have the same precision or consistency in its generalisable claims as e.g. physics. Moreover, it is doubtful that any form of experiment short of actual war could be conducted to support, refute, or validate seapower theories due to war's inherent complexity. Furthermore, whilst unsuccessful experiments are simply a part of the process of scientific investigation in most sciences; unsuccessful military experiments, that is war, cause the downfall of regimes, nations, and world orders. Hence, although seapower theories may have an empirical basis, they are generally not tested, and their range of application are not known.⁴ Military theory is conse-

¹ Julian S. Corbett, *Some Principles of Maritime Strategy* (London: The Project Gutenberg eBook, 1911 (electronic reproduction 2005)), p. 9

² Paraphrasis of: Glenn Voelz, "Is Military Science Scientific?" *Joint Force Quarterly* : JFQ 75 4th Quarter (2014).

³ *Ibid.*

⁴ Paragraph is inspired by: Berndt Brehmer, "The research basis for teaching war studies - or for the officer profession," in *War Studies: Perspectives from the Baltic and Nordic War Colleges* ed. Tom Kristiansen and John Andreas Olsen (Oslo: Institutt for forsvarsstudier, 2007), p. 35., Jerker J Widén, *Theorist of maritime strategy: Sir Julian Corbett and his contribution to military and naval thought*, Corbett centre for maritime policy studies, (Milton Park: Routledge, 2016), pp. 155-156., Robert P. Pellegrini, *The Links between Science, Philosophy, and Military Theory: Understanding the Past, Implications for the Future* (Maxwell Air Force Base: Air University Press, 1997), p. 43, and Henry E. Eccles, "Military theory and education; The need for and nature of," *Naval War College Review* 21, no. 6 (1969): p. 72.

quently not theory in the ordinary sense of empirically tested propositions.⁵ This represent a challenge that is subject to controversy and constitute a major, and persistent, theoretical discourse in seapower theory.⁶

In this paper I will investigate if there are other methods, i.e. in lieu of experimentation, that can lead to coherent and reliable seapower theory, whether universal or specific, normative, or explanatory. There are many research traditions in social sciences. Each tradition is a way to understand knowledge building and its validity, and each tradition comes with their respective ontologies, epistemology, and their corresponding methodological approaches, and they all have their strengths and weaknesses.⁷ Here, I will discuss the incontrovertible most used methodology in seapower theorisation; the use of history to develop and test seapower theory, and the resulting implications for those theories' explanatory and normative status.

DEFINING SEAPOWER THEORY

Seapower theory is a subset of military theory that is intended to explain the nature, character, and characteristics of war in and from the maritime domain.⁸ Thereto a substantial part of seapower theory deals with how navies can be instruments of and influences on foreign policy.⁹ Seapower theory fits well within the broad definition of military theory; i.e. a theory which is primarily concerned with the *nature* and *character* of war as well as the successful conduct of war.¹⁰ This is theory of war employing Clausewitz's ontological understanding of war; meaning that war is, and always has been, organised violence conducted for political ends.¹¹

⁵ Brehmer, "War Studies," 28, and 35-36.

⁶ See for instance: Geoffrey Till, *Seapower: A Guide for the Twenty-First Century* (London: Frank Cass Publishers, 2004), pp. 29-30., and Jan Tore Nilssen in: Harald Højback and Palle Ydstebø, eds., *Krigens vitenskap: en innføring i militærteori* (Oslo: Abstrakt forl., 2012), pp. 183-185.

⁷ Josep Gallifa, "Research traditions in social sciences and their methodological rationales," *Aloma* 36 (01/01 2018). and Stephen D. Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle*, Kindle edition. ed. (Princeton, N.J.: Princeton University Press, 2006), p. 20

⁸ Although not a point of departure for this paper, it can be argued that seapower theory only normally is a subset of military theory. This as, for countries that is entirely depended on the maritime, economically as well as military, it could very well be that seapower theory, or rather maritime strategy, determine their comprehension of military theory, i.e. that the use of sea power is not part of an overall military strategy – but does indeed determine that strategy (Tor Ivar Strømmen, "Bulwark and balancing act: the strategic role of the Royal Norwegian Navy," in *Europe, small navies and maritime security: balancing traditional roles and emergent threats in the 21st century*, ed. Robert McCabe, Deborah Sanders, and Ian Speller (London: Routledge, Taylor & Francis Group, 2020).).

⁹ See for instance: Ken Booth, *Navies and foreign policy* (London: Routledge, 1977 (reprinted: 2014)). In pp. 15-25 Booth explains this elegantly through his seapower triangle.

¹⁰ Jerker Widén and Jan Ångström, *Contemporary Military Theory: The dynamics of war* (London: Routledge, 2015), p. 7.

¹¹ Colin S. Gray, "The Changing Nature of Warfare?," *Naval War College Review* 49, no. 2 (1996): p. 8. A more detailed explanation of the ontology of war according to Clausewitz, is that it places fighting at its centre. Clausewitz claims that fighting is as definitive for war as mone-

The *nature* of war, according to Clausewitz, describes its unchanging essence, meaning those things that differentiate war (as a phenomenon) from other things. The *character* of war describes the changing way that war as a phenomenon manifests in the real world. As war is a political act that takes place in and among societies, its specific character will be shaped by those politics and those societies—by what Clausewitz called the “spirit of the age.” War’s conduct is undoubtedly influenced by technology, law, ethics, culture, methods of social, political, and military organisation, and other factors that change across time and place.¹² Military theory can therefore be described as a comprehensive analysis of all the aspects of warfare, its patterns and inner structures, and the mutual relationships of its various elements.

It also encapsulates political, economic, and social relationships within a society and among the societies that create a conflict and lead to a war. Finally, it includes the use of military force to prevent the outbreak of war and to control escalation after the opening of war.¹³

Military theories are both normative and explanatory. Military theory is multi-disciplinary in so far as one needs to understand the political, strategic, operational, and tactical processes in war, but the subject mainly deals with the military aspects of war – not everything that concerns war.¹⁴

Military history is a body of knowledge about the past that relates to armed forces. Warfare, the employment of organised violence, or the preparation to employ violence, lies at the heart of the discipline.¹⁵ Comparing that my definition of military theory above, one sees that military history and theories both concern themselves with the same topic. So, what does actually set them apart? Widén and Ångström explains this rather elegantly. They write that military theory, unlike history, deals with the general rather than the specific, the abstract rather than

tary exchange for economy. He explicitly defines war as fighting, a duel with violence as it means. War is an act of politics, where the dictation of the law by one side to the other gives rise to ‘a sort of reciprocal action’. War always consists of hostile bodies and each has the same object – to force the other to submit (Astrid H. M. Nordin and Dan Öberg, “Targeting the Ontology of War: From Clausewitz to Baudrillard,” Millennium 43, no. 2 (2014).) Some theorists challenge the continued relevance of Clausewitz’s ontology and his division into unchanging nature, and changing character of war, but is beyond the scope of this paper. See for instance: Jan Ångström and Isabelle Duyvesteyn, eds., Rethinking the Nature of War (London: Frank Cass, 2005). for a good introduction to this debate.

¹² Christopher Mewett, “Understanding war’s enduring nature alongside its changing character,” *War on the Rocks* (January 21, 2014). See also sub-chapter *The use and abuse of history* below where the interaction between the nature and character of war is discussed in more detail.

¹³ Milan Vego, “On Military Theory,” *Joint Force Quarterly* : JFQ, no. 62 (2011): p. 60.

¹⁴ Widén and Ångström, *Contemporary Military Theory: The dynamics of war* p. 7.

¹⁵ Ian Speller, “The use and abuse of history by the military,” in *Building a better future* (Maynooth: Irish Defence Forces: MACE Publications, 2012), p. 2. Stephen Morillo, in his great introductory work to military history have a very similar definition (Stephen Morillo and Michael F. Pavkovic, *What is military history?*, 3rd ed., *What is history?*, (Cambridge: Polity Press, 2017), pp. 3-6.)

the tangible, and the timeless rather than the contextual.¹⁶ In military history, researchers tend to see their specific object of study as meaningful in and of itself, while, in military theory, they view the subject of research as a case of a large universe of comparable phenomena.¹⁷ This does not, however, mean that military historians never theorise or that military theorists never investigate the unique.¹⁸ The difference between their approaches has, however, consequences with regard to the extent that generalisations can be regarded as valid and relevant. The perspective that the object of a historical study is unique per se is, if we take it to its logical conclusion, is not compatible with generalising one's conclusions to other cases. By definition, military theory has, therefore, generalising aims, and it is something "more" than just a description of war and warfare.¹⁹ It often aims to be normative – or is at least viewed as such by many of its practitioners.

SEAPOWERS THEORY AS EXPLANATORY AND NORMATIVE THEORY

A normative theory evaluates and describes, or generalises, facts or causal relations. It states "good" ways of doing things, or the "right" way of thinking. It is essentially a guide, a prescription of norms and standards which its practitioners ought to follow. In seapower theory there is often a tension between explanatory statements about the causal relationships in maritime strategy (what is) and providing norms and guidelines for action (what ought to be). According to Widén, this tension is so profound that seapower theory in a historical sense has been dominated by normative rather than explanatory theory. Seapower theory more often than not promotes new doctrines in naval operations and does not constitute theory to grasp and comprehend maritime war and naval warfare as whole, nor to obtain thrust about the principles of maritime strategy.²⁰ Widén's statement is rather unforgiving, but carries much weight. The explanatory powers of a theory, and hence the enhanced understanding it provides, is key to a good theory of lasting importance. A theory formulated in or to a specific time, technology, or space, would almost by default constitute a theory that, if used under other conditions, would be questionable at best.²¹ Friedrich Hayek identified a similar phenomenon in his own field of economics, notably articulated during his 1974 Nobel Prize lecture, where he points out that circumstances defining outcomes in complex environments are rarely, if ever, fully accessible to the researcher, policymaker, or military planner, no matter how information is collected and acted upon.²² The crux of military theory

¹⁶ Widén and Ångström, *Contemporary Military Theory: The dynamics of war* p. 5.

¹⁷ *Ibid.*

¹⁸ *Ibid.*

¹⁹ *Ibid.*

²⁰ Widén, *Theorist of maritime strategy: Sir Julian Corbett and his contribution to military and naval thought*, pp. 155-156.

²¹ This paragraph is inspired by: *ibid.*, pp. 3-4.

²² Paraphrasis of: Voelz, "Is Military Science Scientific?"

lies in the use of appropriate methods to achieve a satisfactory application of theory to each particular case.²³ That is in fact the domain of doctrine, i.e. applied use military theory in a specific context.²⁴ Hence, when theory becomes normative, it removes itself from theory and tend towards being a specific strategy or doctrine. Thereto, a normative theory is scientifically problematic since it is inherently based on *value judgements* that are difficult to disprove factually and rationally, or which is only relevant for its time and place.²⁵ For instance did Mahan make the conquest and retention of oversea markets dependent not so much upon economical ability as upon military force. A statement that could be seen as fairly accurate in the age of mercantilism, but not so anymore.²⁶

As military theories cannot be refined by continuous testing in a controlled environment, military theory ought to make general, rather than specific, predictions. Such general predictions are much harder to disprove and without continual testing, and hence the ability to prove a theory wrong, other more unscientific influences comes to bear on the relevance of military theory. Tradition, careerism, interservice rivalries, and domestic politics, thus could allow military theories to survive and be used long past the time when they have relevance.²⁷

Furthermore, a majority of the important Western military theorists are associated with the great powers of the world. Moreover, most of the empirical studies focus on cases where at least one side in the contest is a great power, especially so in the maritime domain. This begs the question to what extent there is a great power bias in the field that renders generalisations to smaller powers invalid? There are obviously research results and theoretical arguments, generated from studies of great powers that only partly can be transferred to other countries and areas.²⁸ An important example would be Mahan's renowned seapower theory. Mahan failed to make clear, or at least touched upon only by implication, the fact that all those advantages he promoted were the accompaniment not of Seapower as such, but of superior Seapower.²⁹

²³ Raoul Castex, *Strategic Theories* (edited and translated version of French originals from 1931-39), ed. Eugenia C. Kiesling (Annapolis: Naval Institute Press, 1994), p. 17.

²⁴ Till, *Seapower*, p. 33. and James J. Tritton, *Naval Perspectives for Military Doctrine Development*, NDC (Norfolk, 1994)..

²⁵ This paragraph is inspired by: Widén, *Theorist of maritime strategy: Sir Julian Corbett and his contribution to military and naval thought*, pp. 3-4.

²⁶ Herbert Rosinski, *The Development of Naval Thought: Essays by Herbert Rosinski*, ed. Benjamin Mitchell Simpson III (Newport, RI: Naval War College Press, 1977), p. 28.

²⁷ Pellegrini, *The Links between Science, Philosophy, and Military Theory: Understanding the Past, Implications for the Future*, p. 43. See also: Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca: Cornell University Press, 1991), pp. 1-4.

²⁸ Widén and Ångström, *Contemporary Military Theory: The dynamics of war* p. 3. See also: Milan Vego, *Maritime Strategy and Sea Denial: Theory and Practice* (Taylor & Francis Group, 2018), vii.

²⁹ Rosinski, *The Development of Naval Thought: Essays by Herbert Rosinski*, p. 22.

WHY THE CLOSE INTERRELATIONSHIP WITH HISTORY?

If we investigate the most renowned seapower theories, all of them utilises history as its empirical basis and are littered with historical examples.³⁰ Why is it so? Colin Gray offers a useful, but simplistic answer; History is important to seapower theory because, “historical experience is literally our sole source of evidence on strategic phenomena as the future has not yet happened.”³¹ Along the same lines, Milan Vego says that it is military and naval history that allows a theorist to select historical examples to either clarify or obtain evidence in support of a given statement or theoretical construct.³² That statement is important, as that would likewise mean that other historical examples could weaken or invalidate the very same theoretical constructs.

The interrelationship between history and seapower theories can be traced back to the latter half of the 19th century when Sir John Laughton developed ‘scientific’ naval history as a mean for the ‘higher education’ of naval officers in matters of strategy and tactics.³³ He claimed that the role of naval history was first and foremost as a vehicle for the development of naval doctrine.³⁴ He became hugely influential not only for his methodology, but more so because of his friends and extensive correspondence with the major names in his field – historians like Gardiner, as well as naval intellectuals like the Colomb brothers, Bridge, Mahan, Corbett, and Luce.³⁵ Seapower theories promulgated by this circle of theorists still incontestably constitute theoretical benchmarks in the field. They hold such

³⁰ For instance, Mahan's most influential work, *The Influence of Seapower upon history 1660-1783*, is nearly 80-90% historical analysis. The theoretical synthesis constitutes merely 10% of his work (Alfred Thayer Mahan, *The Influence of Sea Power Upon History, 1660-1783* (New York: Dover Publications, 1890 (reprint:1987))). Some other publications from leading theorists that exemplifies my statement: Julian S. Corbett, *Principles of Maritime Strategy* (New York: Dover Publications Inc., 1911 (reprint: 2004)); Colin S. Gray and Roger W. Barnett, *Seapower and Strategy* (Annapolis: Naval Institute Press, 1989); Castex, *Strategic Theories* (edited and translated version of French originals from 1931-39); Booth, *Navies and foreign policy*; Wolfgang Wegener, *The Naval Strategy of the World War* (translated and reprinted 1989) (Annapolis: Naval Inst Press, 1929); Sergei G. Gorshkov, *The Sea Power of the State* (Annapolis: Naval Institute Press, 1979); Milan Vego, *Operational Warfare at Sea: Theory and Practice* (New York: Routledge, 2009); Edward N. Luttwak, *The political uses of sea power* (Johns Hopkins University Press, 1974); Till, *Seapower*; Eric Grove, *The Future of Sea Power* (London: Routledge, 1990).

³¹ Colin S. Gray, ed., *Strategy and History: Essays on theory and practice* (London: Routledge, 2006), pp. 5-6.

³² Vego, "On Military Theory," p. 66.

³³ Andrew Lambert, *The foundations of naval history: John Knox Laughton, the Royal Navy and the historical profession* (London: Chatham Publishing, 1998), as summed up on the back jacket of the book.

³⁴ *Ibid.*, p. 219. With regards to doctrine: Till, *Seapower*, p. 33. and Tritten, *Military Doctrine Development.*

³⁵ Lambert, *The foundations of naval history: John Knox Laughton, the Royal Navy and the historical profession*, as summed up on the back jacket of the book. The Colomb brothers, Bridge, Mahan and Luce are undoubtedly among the most important writers and theorists of sea-

a status that it has almost led to a paradigmatic interrelationship between naval history and seapower theory. An interrelationship that continues to dominate sea-power discourse to this day, and which has caused numerous other naval intellectuals to adopt akin methodology to Mahan.³⁶ Similar theoretical developments also took place amongst, for instance, Swedish and French naval theorists, and almost independently from Anglo-Saxon thinking.³⁷ Hence, thinkers with very different outlooks came to use basically the same approach to develop their theories.

This almost paradigmatic interrelationship is not without rationale, it is actually fairly obvious. The study of military history offers the opportunity to learn from experience that is longer, wider and more varied than that of any individual.³⁸ Which is especially important for a profession that is, hopefully, never or very seldom used for its ultimate purpose. Or in Michael Howard's words "The military professional is almost unique in that he may only have to exercise his profession once in a lifetime, if indeed that often."³⁹ Ian Speller thus claims that an understanding of history is a necessary requirement for any theory of war that is based on more than unfounded speculation.⁴⁰ Unfortunately, the mere occurrence of copious references to historical case studies does not tell us anything about the theory's factual qualities. In the better cases, history is used as evidence upon which theory is based, in other cases, history is nothing but cosmetics for a theory devised totally independent of serious historical research.⁴¹ Military theories

power in its formative phase in the late 19th century. The Colomb brothers in particular were seminal in the use of history to assist in the advancement of naval theory (Charles Oliviero, "The Complex Web of Western Military Theory (A New Model for the Investigation of Western Military Theory)" (PHD Royal Military College of Canada, 2006), p. 175.)

³⁶ Examples include, but is certainly not limited to: a Swedish work by Munthe and Unger in three volumes: Arnold Munthe, *Sjømaktens inflytande på Sveriges historia*, 3 vols., vol. 1 (Stockholm: Marinlitteraturföreningens förlag, 1921); Arnold Munthe, *Sjømaktens inflytande på Sveriges historia*, 3 vols., vol. 2 (Stockholm: Marinlitteraturföreningens förlag, 1922); Gunnar Unger, *Sjømaktens inflytande på Sveriges historia*, 3 vols., vol. 3 (Stockholm: Marinlitteraturföreningens förlag, 1929). and the German Hermann Kirchhoff, *Seemacht in der Ostsee*, 2 vols. (Kiel: Corodes, 1908).

³⁷ In Sweden Julius Mankel used Swedish naval history to formulate strategic and tactical guidelines for Swedish naval forces already in 1855. (Julius Mankell, *Studier öfver svenska skärgårds-flottans historia, krigssätt och användande vid Sveriges försvar* (Stockholm: Hörbergsgka boktryckeriet, 1855).) Likewise, the French *Jeune Ecole* naval theories from the 1870's was partly based on France's long historical experience with *guerre de course*, i.e. commerce raiding. (Rolf Hobson, *Krig og strategisk tenkning i Europa 1500-1945 : samfunns- endring, statssystem, militær teori* (Oslo: Cappelen akademisk forl., 2005), p. 250. and Arne Røksund, *The Jeune École: The Strategy of the Weak*, 1st ed., *History of Warfare Series volume 43*, (Leiden: Brill, 2007), pp. 1-5.)

³⁸ Basil Henry Liddel Hart, *Why Don't We Learn from History?* (Philadelphia: Lulu Press, 1971 (as reprinted in 2015)), Part 1.

³⁹ Michael Howard, "The use and abuse of military history," *Royal United Services Institution. Journal* 107, no. 625 (1962): p. 6.

⁴⁰ Speller, "The use and abuse of history by the military," pp. 9-10.

⁴¹ *Ibid.*, p. 9.

removed from thorough historical analysis and understanding is thus often, to quote Colin Gray, “repackaging the obvious in ways that mislead the credulous.”⁴² Such theories, according to Speller, does not add much intellectual value as they are often nothing but pure speculation and can accordingly often be badly flawed.⁴³

THE USE AND ABUSE OF HISTORY

Although historical analysis as shown constitutes a major component in developing and formulating military theory, the way it is used varies widely. Its use is not one but numerous related approaches that could be classified along the lines of for instance event-centred empirical analysis and comparative historical analysis. Regardless of definitions, pitfalls, and incomplete data, the use of history by sea-power theorists irrespectively aims at making generalisations and identify causal relationships on basis of historical analysis. But could we use historic analysis for such a purpose?

With historical example as its laboratory, military theory relies on ex post facto analysis of what are essentially natural experiments. This entails several limitations. As a mode of analysis, historical narrative is fundamentally linear and deterministic by nature. Its aim is to find causality, thereby minimising the role of chance. It veils complexity and shies from ambiguity. Its vernaculars tend toward the anecdotal, interpersonal, and spectacular. History does not always know what it does not know. Ultimately, what it provides is reasoning by induction—drawing general rules from specific examples. It is non-empirical in that it relies on uncontrolled data. Perhaps most importantly, as a basis for applied theory, it lacks mechanisms of validation through experimental replication—the essence of scientific methodology.⁴⁴

However, if we on the other hand look at how Sir Michael Howard approach this issue, a more constructive and positive view emerge. Howard once wrote that “even after all allowances have been made for contextual differences throughout history, wars have elements that resemble each other more than they resemble other human activities. Wars are nothing but men trying to impose their will on one another by violence.”⁴⁵ All wars, according to such a view, thus consist of features that are unchangeable or constant regardless of the era in which they are fought and those that are transitory or specific to a certain era. This is arguably one of the most important aspects of Clausewitz’s concept of war, an aspect in which a phenomenon, war, is considered to have both objective and subjective natures.⁴⁶ The objective *nature of war* includes those elements – such as violence, friction,

⁴² Colin S. Gray, *Another Bloody Century: Future Warfare* (London: Weidenfeld & Nicholson, 2005), p. 143.

⁴³ Speller, “The use and abuse of history by the military,” pp. 9-10.

⁴⁴ Voelz, “Is Military Science Scientific?”

⁴⁵ Howard, “The use and abuse of military history,” p. 7.

⁴⁶ Sir Michael Howard was an ardent student of Clausewitz, see: Beatrice Heuser, “Captain Professor Sir: Some Lessons from Michael Howard,” *War on the Rocks* (February 27, 2020 2020).

chance, and uncertainty – that all wars have in common. By contrast, the subjective nature of war (*the character of war*) encompasses those elements – such as military forces, their doctrines, weapons, as well as environments (land, sea, air, and danger) in which they fight – that make each war unique. According to Clausewitz's concept, the objective and subjective natures of war interact continuously. Thus, the nature of war cannot be separated from the means and the actors involved in its conduct.⁴⁷ Generalisations on basis of the nature of war will therefore have a degree of universal applicability and does consequently delineate changes in the character of war. This even as, also according to the Prussian, war's nature does not change—only its *character*.⁴⁸

Military historians since Thucydides have extended their gifts into the present. Machiavelli, Clausewitz, Delbrück, Fuller, Liddel Hart, Mahan, Corbett, the Colomb brothers, Till, Howard – and the list goes on, were not imprisoned by their discipline. They readily engaged in great questions of their time – and indeed this was what led to them developing military and naval theory. Among military theorists, Clausewitz, and Delbrück in particular, were careful to draw a distinction between the attainment of knowledge and the use of it, between military history and what they call military criticism. They held that while history and criticism served different ends, scholars could serve both without violating their professional oaths. Indeed, they felt it essential that they do so. What they had in mind was not the application of military history so much as the application of the military historian. Military criticism was a means to advance an understanding of war.⁴⁹

The godfather of seapower theories, Mahan, suggests an outline for analysing and understanding wars as they have occurred in history. This outline is an indispensable aid in keeping clearly in view the essential points around which further analysis can be made. He said that regardless of whether a belligerent is in a strategically offensive or defensive position, he must establish a hierarchy of objectives. This hierarchy should include immediate, middle-range and long-range objectives;

⁴⁷ Antulio J. Echevarria II, *Globalization and the Nature of War*, Army War College: Strategic studies institute (2003), pp. v-vi.

⁴⁸ Mewett, "Understanding war's enduring nature alongside its changing character."

⁴⁹ Roger Spiller, "Military History and Its Fictions," *The Journal of Military History* 70, no. 4 (2006): p. 1093. See also: Peter Paret, "Hans Delbrück on Military Critics and Military Historians," *Military Affairs* 30, no. 3 (1966). To further detail this statement with regards to Clausewitz: Clausewitz formulated a body of significant considerations and dynamics for which no hard evidence could exist, and insisted that these factors had to be imagined and related to known historical facts in order to comprehend the moral aspect of supreme command. In other words, a critical component of the larger theoretical edifice presented in *On War* defined the terms of synthesis of that for which there was no record, and thus neither summarised nor distilled history, but complemented it. (Sumida, "The relationship of history and theory in *On War*: the Clausewitzian ideal and its implications," *The Journal of Military History* 65, no. 2 (2001). See also: Pellegrini, *The Links between Science, Philosophy, and Military Theory: Understanding the Past, Implications for the Future*, p. 45. and Azar Gat, *A history of military thought: from the Enlightenment to the Cold War* (Oxford: Oxford University Press, 2001), pp. 182, 193-194, and 254-255.)

the geographical areas for the main effort; and the geographical areas for the secondary effort, where defence can be distracted, and strength dissipated in favour of the primary areas.⁵⁰ When analysing naval warfare, present or historically, through such a lens, Mahan drifts towards being a military critic rather than a military historian – which indeed could be said to be what differentiates a seapower theorist from a naval historian.

Whenever discussing applied use of history, it is wise to consider whether the course of history can be regarded as a laboratory for testing hypotheses at all. In his monumental, *A Study of War*, Quincy Wright suggested that generalisations are possible if one can identify the right perspective.⁵¹ Gaddis on the other hand, claims that whenever we set out to explain a phenomena, such as a historical phenomenon, we cannot replicate; everyone in some way or another relies upon acts of imagination.⁵² However, military theory is not about predicting the future but preparing for it. Therefore, by using history to develop and test theory, even if the historical empirical data is inaccurate, it still expands the ranges of experience, both directly and vicariously, and hence renders military theory using history as its laboratory more scientific. At the very least, it helps identifying the questions that ought to be asked and the issues that need to be thought through.⁵³ And even as history does not provide prescriptions, it is still an aid to prediction for the simple reason that what happens tomorrow is not independent of what happened today or yesterday. ‘The future has no place to come from but the past,’ wrote Richard Neustadt and Ernest May, so the study of the latter inevitably sheds some light on what to expect in the former.⁵⁴

Another important question is to determine what kind of historical analysis one could use and how it should be employed. History is always an interpretation made by a historian. Moreover, history is usually written with hindsight, and events are often analysed out of context. Such combinations can easily lead to conclusions and generalisations entirely unfounded in what actually took place, and more so if used for preconceived ends or to underline a particular line of thought.⁵⁵ Having this in mind whilst reading, for instance, Mahan provides some disturbing insight. Mahan wrote didactic history, it really makes little difference which of his books on the influence of seapower one reads: The lessons will be the same.⁵⁶ He wrote history that patterns the past after the present, in which what might be learned from the

⁵⁰ Rosinski, *The Development of Naval Thought: Essays by Herbert Rosinski*, p. xiii.

⁵¹ Widén and Ångström, *Contemporary Military Theory: The dynamics of war* p. 174.

⁵² John Lewis Gaddis, "History, Theory, and Common Ground," *International Security* 22, no. 1 (1997): p. 78.

⁵³ *Inspired by Michael Howard, The Lessons of History* (Oxford: Clarendon Press, 1991), p. 11., and Till, *Seapower*, p. 27.

⁵⁴ Richard E. Neustadt and Ernest R. May, *Thinking in time: the uses of history for decision-makers* (Free Press, 1986), p. 251.

⁵⁵ John E Jessup Jr. and Robert W. Coakley, *A guide to the study and use of military history* (Washington DC: Center of Military History, United States Army, 1979), p. 76.

⁵⁶ *Ibid.*, p. 80.

event or pattern rather than the historicity of the event itself was important. Mahan thus represents a line of theorists on war who used history for preconceived ends.⁵⁷ Mahan's methodology must therefore be questioned, but his findings ought not to be discarded. His counsel is of abiding value maybe not so much for the answers, but because they help to identify the questions that need asking.⁵⁸

To conclude I turn to John Lynn who writes that: military history can be used to recognise trends and provide advice. Moreover, while events do not repeat themselves, patterns in war can usefully be discerned. For example, on the conventional battlefield, there are only so many operational gambits available to the commander. Options such as penetration of the enemy's centre or left or right turning movements were available to Alexander the Great and Julius Caesar.⁵⁹ Likewise, the strategic options that command of the seas offered Rome during the Second Punic war are very similar to what seapower offered the British during the 18th century, and even translate directly to contemporary options and challenges experienced by states that must account for the maritime in their strategic decision-making.

CONCLUSIONS

*But it must never be forgotten that the true use of history is not to make men clever for next time; it is to make them wise forever.*⁶⁰

Sir Michael Howard

Throughout this text I have questioned whether seapower theories holds explanatory value or even normative status with regards to maritime strategy and naval warfighting. The short answer is – yes, they do, but probably only if they are understood or placed in context. Their applicability beyond their time, technology and space is undetermined and will likely remain so. Naval warfare is scarce, far between, and a complex social activity, hence, experimentation analogous to hard sciences is unattainable. Instead of experimentation, seapower theory rests firmly on generalisations drawn from historic analyses. However, such applied use of history is not without pitfalls and scientific challenges. One cannot simply learn from history as history does not teach lessons.⁶¹ However, all future events always come from no other place than the past. The past hence inevitably sheds light on

⁵⁷ Amos Perlmutter and John Gooch, *Strategy and the social sciences : issues in defence policy* (London ;Totowa, N.J.: F. Cass, 1981), p. 32

⁵⁸ Geoffrey Till, ed., *Maritime strategy and the nuclear age 2. ed.* (London: MacMillan, 1984), p. 258.

⁵⁹ Gary Sheffield, "Military past, military present, military future: The usefulness of military history," *The RUSI Journal* 153, no. 3 (2008): p. 104.

⁶⁰ An abbreviated quote from the closing paragraph of: Howard, "The use and abuse of military history."

⁶¹ This line is borrowed from Michael Howards famous statement "History does not teach lessons. Historians may claim to teach lessons, and often they may do so wisely, but 'history' does not." See Howard, *The Lessons of History*, p. 11.

what to expect in the future. History is our only empirical source to how seapower works, and such insight ought primarily not to be used to describe or predict the future, but to criticise and to guide our understanding. Such generalisations can be derived from history – if history is studied as Sir Michael Howard concluded in his 1961 seminal essay; in width, only by seeing what does change can one deduce what does not; in depth, one must get behind the order subsequently imposed by the historian and recreate the omnipresence of chaos and criticise; and lastly in context, as wars are conflicts of societies.⁶²

But most importantly, using history alone is not the perfect methodology to develop and evaluate seapower theory regardless of method, sources or how one conjunct knowledge. History is certainly important, even vital, especially as a vast, but opaque, source of empirical data. Still history is always influenced by hindsight, imagination, and interpretations, and depict a context long gone. Hence, use of military and naval history ought to be combined with other methods when theorising seapower. Taken together, a combination of contrasting approaches offers an opportunity to cover the weaknesses of each with the strengths of others. However, what those methods are, or could be, is beyond the scope of this paper.

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⁶² Michael Howard, "The use and abuse of Military history (reprint of 1961 original)," *Parameters* 11, no. 1 (1981).

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“Navigare necesse est, vivere non necesse”

The quote is attributed to Pompey (56 BC), who used it to urge his sailors on when they refused to set sail on a stormy sea, in order to bring grain from Africa to Rome where people were starving. This is a task familiar to every naval officer: to do his or her duty to society when the situation demands it, is more crucial than own survival. The quote means, literally, “It is necessary to sail, it is not necessary to live”. This means that it is necessary to depart, even if you are not at all sure that you will ever arrive.

It is more “necesse” than ever that we set sail within the academic world. The picture on this last page, the possible monster, Nessie of Loch Ness, symbolizes our quest for knowledge within the naval domain. What is truth? With what kind of certainty can we claim to know the truth? These are central questions whether dealing with a monster or with naval warfare. It is an ongoing process that makes us wiser but not certain. The Royal Norwegian Naval Academy dates back 200 years and the purpose of our magazine is to put our competence, or sometimes even the lack of it, out into the open for debate. We have a threefold wish; to invite to debate and reflection, to present competent arguments, and to publish knowledge gained through peer reviewed research. In short, we have a deep desire to present through “Necesse” our latest academic thoughts, research and efforts concerning anything that is important to a naval officer. “Necesse” will include scientific articles, especially brilliant bachelor papers by our cadets, and works of scholars at our own Academy or others writing within the naval officer sphere.

