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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 strengthen 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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