



# PROCEEDINGS OF THE ELEVENTH ANNUAL ACQUISITION RESEARCH SYMPOSIUM

---

## WEDNESDAY SESSIONS VOLUME I

Exploring Service Innovations in Performance Based  
Contracts in the Swedish Defence Sector: A Case Study  
of SK 60 Trainer

Michael Dorn, The Swedish National Defence College  
Thomas Ekström, The Swedish National Defence College

**Published April 30, 2014**

Approved for public release; distribution is unlimited.

Prepared for the Naval Postgraduate School, Monterey, CA 93943.



The research presented in this report was supported by the Acquisition Research Program of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact any of the staff listed on the Acquisition Research Program website ([www.acquisitionresearch.net](http://www.acquisitionresearch.net)).



ACQUISITION RESEARCH PROGRAM  
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY  
NAVAL POSTGRADUATE SCHOOL

## Panel 3. Enhancing Acquisition Outcomes Through Performance-Based Contracting

---

Wednesday, May 14, 2014	
11:15 a.m. – 12:45 p.m.	<p><b>Chair: Stan Z. Soloway</b>, President and CEO, Professional Services Council</p> <p><b>Discussant: David Lamm</b>, Professor Emeritus, Naval Postgraduate School</p> <p><b><i>HIMARS: A High Performance PBL Case Study</i></b> William Lucyshyn, University of Maryland Jacques Gansler, University of Maryland</p> <p><b><i>Exploring Service Innovations in Performance Based Contracts in the Swedish Defence Sector: A Case Study of SK 60 Trainer</i></b> Michael Dorn, The Swedish National Defence College Thomas Ekström, The Swedish National Defence College</p>



# Exploring Service Innovations in Performance Based Contracts in the Swedish Defence Sector: A Case Study of SK 60 Trainer

**Michael Dorn**—is a carrier officer at the Swedish Armed Forces. In 2008, he became a PhD candidate at the Jönköping International Business School. Presently he serves as a teacher at the Swedish National Defense College. His field has primarily been military logistics and defense acquisition. His research focuses on partnering arrangements and service innovation in a defense context. Dorn was promoted to lieutenant colonel in 2006 and holds an MBA in international logistics and supply chain management. [michael.dorn@fhs.se]

**Thomas Ekström**—is deputy research director at FOI, the Swedish Defence Research Agency. Ekström has been an operational researcher at FOI since 1994. Since 2002, his research focus has primarily been on military logistics and increasingly also on defense acquisition. Since 2009, he has been an industrial PhD candidate at Lund University in Sweden, where his research has been focused on public–private business models for defence acquisition. Ekström holds a Licentiate of Engineering in Engineering Logistics, a Master of Science in Military Operational Research and a Master of Science in Industrial Engineering. [thomas.ekstrom@foi.se]

## Abstract

This study takes its starting point in the restructuring of Swedish defence and broadens the view of innovation as a result of new types of partnering arrangements. In Sweden, innovation has played an important role in the development of submarines, aircraft, and other types of military capabilities. The focus has primarily been on technological innovation, but the authors argue that innovation within the defence sector not only requires an ability to address technological innovation, but also needs to embrace all other forms of innovation.

This narrow view of innovation seems to be global. Traditional defence acquisition has established complex regulations, managerial practices, and organizational structures, which might hinder innovation. However, new forms of contracts, such as performance based contracting and contracting for availability, seem to offer new opportunities in terms of ways for private firms to package and deliver military capabilities to the armed forces.

This paper aims to explore the understanding of service innovation in complex defence acquisition projects. The theory is applied to the Swedish defence sector and the frame of reference has emerged through a literature review within the field of PBC and service. The article concludes by presenting insights from a longitudinal qualitative case study, that is, the outsourcing of the SK 60 trainer aircraft, used for training fighter pilots who reflect phases such as concept development transition and service support.

The paper evaluates the motivation behind military innovation and what it is important to look at within processes, rules, and norms of the defence acquisition system and interaction within the defence establishment. Previous studies have not explicitly considered service innovation within the defence and security industry.

## Introduction

This study takes as its point of departure the restructuring of the Swedish defence sector, and focuses on the concepts of Performance Based Contracts (PBC) and service innovation as vehicles to explore and explain different aspects of value co-creation in new types of partnering solutions, for example, Public Private Partnerships (PPPs), outsourcing and so forth, in the Swedish defence sector.

Traditionally, the defence capability development process in Sweden has been characterized by cooperation and co-creation of value between the Armed Forces, the



Defence Materiel Administration (FMV), which is the Swedish Defence Procurement Agency (DPA), and the domestic defence industry. In the process of co-creation of new defence capabilities, technological innovation has played an important role in the development of state-of-the-art combat vehicles, submarines, and fighter aircraft.

However, the Swedish government's recently adopted policy holds that development of military capabilities should now be financed by the private sector rather than by the public sector. This has resulted in a situation where the defence industry is necessitated to widen its view of innovation, and also embrace the services aspect. Instead of the traditional value proposition, where equipment and support were divided into different offerings, the defence industry now moves in the direction of offering integrated product-service bundles, that is, Performance Based Contracts (PBC). From the point of view of the public sector, the idea behind this is to invite the industry to assume a larger responsibility for the entire life cycle of the system and to incentivise industry to decrease the Total Cost of Ownership (TCO).

The term *servitization* is often used to describe the general trend in many industrial sectors towards combinations of products and services, for example, Product-Service-Systems (PSS), as integrated solutions to customer problems (Davies et al., 2007; Oliva & Kallenberg, 2003). Baines et al. (2009) define servitization as "*the innovation of an organization's capabilities and processes to better create mutual value through a shift from selling product to selling products and services,*" which indicates a transition from product-oriented to use-oriented and result-oriented aspects (Tukker, 2004) of manufacturing, which is closely associated with PBC (Baines et al., 2009; Neely, 2008).

The current view on innovation within the defence sector seem to predominantly focus on technology and equipment and thus tends to forget to take into account the aspects which come with Product-Service-Systems (PSS) and servitization of manufacturing (Bracken et al., 2005). This narrow focus seems to be a global pattern in the defence and security industry (Bracken et al., 2005; UK MoD, 2005). Very little research exists on the challenges associated with the transition from traditional asset acquisition to acquisition of complex services (e.g., Lindberg, 2008).

In this paper we argue, in line with the DIS (2005), that the defence community needs to improve the way it articulates its requirements and visions across a Through Life Capability Management (TLCM<sup>1</sup>) perspective, so that it does not miss innovation opportunities, especially opportunities to find new ways of cooperation and new ways of packaging and delivering efficient and high quality service solutions. Therefore, the purpose of this paper is to explore how innovation contributes to the creation of value and how value is perceived by the buyer, suppliers and end-users. This leads to the formulation of two research questions: "What types of values are generated in the PBC from the respective perspectives of the buyer and the supplier?" and "How are these different types of value generated?"

The setting for the reported case based research is the Swedish defence sector and the case is the Performance Based Contract involving the outsourcing of services concerning the Saab 105 jet trainer air craft, known as the SK 60 in the Swedish Armed Forces.

---

<sup>1</sup> Through Life Capability Management (TLCM) can be regarded as a UK equivalent of the U.S. Total Life Cycle System Management (TLSCM).



## Research Framework

### *Defence Acquisition*

The acquisition and management of military capability is increasingly complex and costly and requires a holistic approach to increase effectiveness and efficiency. Consequently, there is a need for a wider view of innovation in the defence sector. According to Moulas-Gallar (2006), defence innovation goes beyond changes in systems and technology. It covers many areas it covers innovation in: military doctrine/operations, military systems, military logistics and support and acquisition which lead to process and organizational change. To improve the output, the British Defence Innovation Strategy (MoD, 2007) suggests that an integrated approach to acquisition and In-Service management of military capabilities must be developed in order to define where innovations occur and where service innovations can take place. This means taking a Through Life Capability Management (TLCM) into account, that is, to emphasise the importance of simultaneously taking all components of military capability, i.e., Defence Lines of Development (DLoDs) into consideration. In the UK, the DLoDs are constituted by Training, Equipment, Personnel, Information concepts and Doctrine, Organisation, Infrastructure and Logistics (TEPID OIL<sup>2</sup>).

Extant literature on innovation in a defence context has largely been concerned with the sources and motivations for defence innovation and mostly contributed within technological innovation and less to organisational and doctrinal innovation (Dimond, 2006). This is also supported by Bracken et al. (2005), who suggest that using business models from industry will expand the existing defence innovation landscape from a focus on products (airplanes, tanks, ships), to also emphasize processes (integrated systems), and retrofits of legacy systems. The adoption of the TLCM perspective means that we must challenge the prevalent assumptions that new requirements inevitably lead to the production of entirely new platforms or systems. Rather, TLCM highlights the fact that capability enhancement can often be achieved more effectively and efficiently through innovation across other DLoDs, in already existing capability. Expected effects of such innovations are cost savings, and enhanced performance (Molas-Gallart, 2006). The shift from acquisition to a lifecycle perspective on capability requires that the nature of innovation changes. This involves a shift from planned technology delivered as part of a project, towards a series of dynamic innovations cycles involving software upgrades and technology insertion (Miemczyk et al., 2013). This shift of innovation, from traditional procurement to also cover the later phases such as In-Service, links the concept of servitization and service innovation.

According to Dombrowski and Gholz (2006), joint ventures and partnering with the defence industry can be a generator of new types of innovations which can support defence transformation, which requires innovation, but not necessarily technological innovation. However, innovation is not restricted to what is acquired, that is, components of capability, but should also embrace how a DPA acquires capability. In traditional defence procurement, established and complex sets of laws, regulations, managerial practices and organizational structures constitute significant challenges for innovation (Gallart, 2006). Consequently,

---

<sup>2</sup> The UK capability components Training, Equipment, Personnel, Information, concepts and Doctrine, Organisation, Infrastructure and Logistics (TEPID OIL) are the equivalent of the US capability components Doctrine, Organisation, Training, Materiel, Leadership, Personnel, Facilities (DOTMLPF).



when evaluating what motivates innovation in the defence sector, it is important to look at the internal processes, that is, the rules and norms of the defence acquisition system, as well as the interactions between the defence establishments (Dimond, 2006).

In the UK, an integrated approach to lifecycle based sequential acquisition has been implemented. The approach has two variants, CADMID (Concept, Assessment, Demonstration, Manufacture, In-Service, Disposal) for equipment and CADMIT (Concept, Assessment, Demonstration, Migration, In-Service, Termination) for services. In this paper, CADMIT will be used to categorise different types of innovation.

### ***Service Innovation***

During the past decades the research in services and innovation has received increasing interest (Edvardsson, 1997; Dodgson, 2000; Tidd & Hull, 2003; Tidd, 2005; Davies & Bessant, 2007; den Hertog, 2010). The trend in the manufacturing industry has been that firms add value by integrating products and services into product–service bundles (Chae, 2012; Kindström et al., 2012; Ulaga & Reinartz, 2011), often as part of a solution to gain access to new markets, through a transition from “sale of products” to “sell of use” (Baines et al., 2007), for example, Power by the Hour (PBH). Despite the fact that the defence industry has been protected by national interests and supported by government for a long time, and still is to some extent, the understanding of servitization is growing also in the defence industry. One of the reasons for this development is the realisation that profitability is to be found in the selling of services, since the sales of platforms and advanced equipment is decreasing.

The authors of this paper subscribe to the definition of service provided by Gadrey et al. (1995): “to produce a service is to organize a solution to a problem (a treatment, an operation) which does not principally involve supplying a good; it is to place a bundle of capabilities and competences (human, technological, organisational) at the disposal of a client and to organize a solution, which may be given to varying degrees of precision,” which implies that, apart from technological capabilities, human and organizational capabilities are essential aspects of providing services, and should therefore be accounted for. In other words, firms should not focus on the production, instead they should “provide customers with value satisfaction and co-creation of value as well as value in-use” (Vargo & Lusch, 2004). This means that the quality of the service is dependent on the resources both parties bring into the process, and that technological and non-technological innovation should not be independent but rather reflect a synthesis perspective (Rubalcaba et al., 2010; Gago & Rubalcaba, 2007) leading to a broadening of the research field and new insights into how firms could manage innovation.

A definition of service innovation of importance for the reported research is provided by Ostrom et al. (2010): “service innovation creates value for customers, employees, business owners, alliance partners and communities through new and/or improved service offerings, service processes, and service business models.” This implies that it is the value creation that is central, and how the service innovation can contribute to this value creation; both with new/improved service offerings and service processes (and also business models). The objective of service innovation is to create value for many actors: customers, employees, business owners, alliance partners, and community. It is therefore not enough to concentrate service innovation to only contribute with value for a business owner; it is also necessary to focus on realising customer value. This expanded interpretation of innovation, from traditionally having been associated with the creation of a new technology, to becoming creation of value in a business value chain can be explained by with three approaches: assimilation, demarcation and synthesis (Coombs & Miles, 2000; Drejer, 2004; Droege et al., 2009; Vence & Trigo, 2009). In this study it makes sense to adhere to the synthesis





perspective, which emphasizes the need for an integrated innovation approach that considers both technological (i.e., product-oriented innovation) and non-technological (i.e., service-oriented innovation) perspectives, that is, a unified framework (Coombs & Miles, 2000; Gallouj & Savona, 2010; Gallouj & Windrum, 2009). This is in line with the broader perspective of innovation representing the Lille school of thought<sup>3</sup> and also reflects a neo-Schumpeterian perspective<sup>4</sup> of innovations. This approach carries the advantages that it except, integrating the perspective of, and facilitates comparisons between innovation in manufacturing and service industries. Second, by integrating the demarcation approach into a new synthesis, it allows the integration of technological and non-technological dimensions of innovation into a single perspective that is likely to shed new light on the multidimensional facets of innovation which suit the study of a PBC.

Leaving the somewhat abstract level of discussing the Meta perspectives, we will here adhere to the contemporary research that investigates service innovation from a synthesis perspective and build from prior studies (den Hertog, 2000, 2010; Tether, 2004; Kuusisto & Meyer, 2003; Sundbo & Gallouj, 1998; Tether et al., 2002). A synthesis approach of service innovation captures several aspects, such as content and characteristics of innovation, as exemplified by Gallouj and Werinstein (1997), who proposed an integrative approach where service innovation can be found in four dimensions: service outcome characteristics (the final user's value), service provider competencies (new knowledge and new skills), service provider technology (new IT systems, new machines, new infrastructure), and client competencies (e.g., customer resources, customer knowledge). With this view, service innovation is not defined as a result, but as a process (Gallouj and Savona, 2009). Other researchers (e.g., Amara et al., 2009; den Hertog et al., 2010; Drejer, 2004) also advocate a synthesis approach to innovation, including both technological and non-technological aspects. Amara et al. (2009) suggest six types of innovation. Product innovation relates to the introduction into the market of any new or significantly improved products (goods or services). Process innovation relates to the introduction of any new or significantly improved production process (but not delivery, unless this is integral to the process of production/delivery). Delivery innovation relates to the development of changes in how the enterprise delivers its products (goods or services) to its customers. Strategic innovation relates to the implementation of new or significantly modified business strategies.

---

<sup>3</sup> Innovation literature suggests that there are at least two schools of thought that have been popularly followed (Chamberlain, Doutriaux, & Hector, 2010). The first one is the "supplier-dominated perspective" mainly based on the work of Keith Pavitt (1984), who designed taxonomy of innovation and classified service firms as being passive adopters of new technologies developed by the manufacturing industry. This perspective highlights the technology driven approaches on innovation that dominated much of the innovation literature during the early 1980s till mid-1990s. The second school of thought is known as "The Lille School" and mainly inspired by the ideas of Gallouj. This stream argues that service innovation needs a broader perspective than just technology.

<sup>4</sup> Schumpeter is considered as the father of innovation and provided an entrepreneurial perspective of innovation. According to Schumpeter (1934) innovation is defined as 1) the introduction of a new good that is one with which consumers are not yet familiar, or of a new quality of a good; 2) The introduction of a new method of production, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially; 3) The opening of a new market, which is a market into which the particular branch of manufacture, or the country in question, has not previously entered, whether or not this market has existed before; 4) The conquest of a new source of supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created; and 5) The carrying out of the new organization of any industry, like the creation of a monopoly position (for example, through trustification) or the breaking up of a monopoly position.





Examples include targeting different markets, implementing new or significantly modified missions. Managerial innovation relates to the implementation of new or significantly modified managerial techniques. Examples include the introduction of knowledge management, practices, and quality circles. Marketing innovation relates to the implementation of new or significantly modified marketing strategies and concepts. Examples include the introduction of new or significantly improved marketing methods.

Den Hertog (2000, 2010) also provides a framework of six different dimensions which can be used to analyse where service innovation may occur. The service concept describes the value (value proposition) that is created by the service provider in collaboration with the customer. The customer interaction focuses on the role the customers play in the co-creation of value and is a part of the interaction process between the provider and the client. The value system highlights the set of new business partners, that is, actors involved in jointly co-producing service innovations, where new services are developed in large communities, linked through platforms and networks of businesses. The revenue model refers to innovation in revenue models to fit a new service concept. The underlying understanding is the shift from a product-based revenue model towards a much more customized service-based revenue model, where profits made on client-specific service-contracts count, rather than selling platforms and spare parts. The delivery system is made up of personnel, organization, culture, and technology. The first three components refer to the soft elements of the service delivery systems, that is, the organizational structure of the service company itself. New services, for example, may require new organizational structures: individual capabilities or team skills. Technology in the delivery system refers to ICTs as a central enabler for numerous service innovations. Examples range from electronic government and e-health, customization of services, introduction of self-service concepts, virtual project teams, and so on. Another example could be new ICT systems and logistics solutions, both at corporate and decentralized level. Den Hertog (2010) argue that these dimensions of innovations are not independent and state that in real life, it is difficult to provide 'pure' examples of the above-mentioned dimensions, as most new services will involve a simultaneous combination of changes in various dimensions. This is also in accordance with Bessant and Davies (2007) and Tidd (2011), who suggest a framework consisting of four dimensions: product/service innovation (changes in the things [products/services]), process innovation (changes in the ways in which products/services are created and delivered), position innovation (changes in the context in which the products/services are introduced), and paradigm innovation (changes in the underlying mental models which frame what the organization does). The view by the authors is that the individual dimensions impact each other, and, following Den Hertog (2010), that most new services will involve a combination of changes in various dimensions at once.

To conclude, service innovation is a multi-dimensional phenomenon, which implies that service innovations can take various forms and be linked to different parts of the value creation process in a value chain. Service innovation is not only about processes and content. It is about value generation and change in several dimensions. However, most existing service innovation frameworks focus on changes in suppliers' service offerings (value propositions), but tend to forget to take into account other aspects in the value chain (Berggren & Bergquist, 2006) or business model (Chesborough & Schwartz, 2007). In order to include all aspects of service innovation, we propose the following definition:

*Service innovation* is the multidisciplinary process which primary aim is to attempt to increase different aspects of value for customers and the service providers.



There is a great overlap among the different descriptions of the service innovation dimensions. The one apparent exception is paradigm innovation as suggested by Bessant and Davies (2007) and Tidd (2011). For the purposes of this paper the dimensions suggested by Bessant and Davies (2007) are selected.

### ***Performance Based Contracting***

Performance based contracting (PBC) has emerged as a promising strategy for effective and efficient sourcing of goods, services and integrated bundles of goods and services (Datta & Roy, 2011; Kim et al., 2007). PBC is closely associated with the new emphasis on buying and selling “performance,” “results,” or “outcomes” in manufacturing and service industries, in the private, as well as in the public, sector (Hypko et al., 2010; Hooper, 2008). An early example of PBC is Roll Royce’s “Power by the Hour” (PBH) 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).

PBC has been used in different public sectors, such as infrastructure and hospitals, and is also highly relevant to the defence sector, where contracts for availability and capability has been adopted by the U.S. and European defence agencies as a performance-oriented acquisition strategy (Ng et al., 2009; Sols et al., 2007, Ekström, 2013).

There are a growing number of academic papers published on PBC (Selviaridis, 2011). One of the reasons why PBC is gaining in academic attention is its linkage to research on the servitization of manufacturing, and incentives, which is often implemented in the shape of result-oriented product-service systems (PSS; Baines et al., 2009).

Depending on the context of application, there is a wide variety of terms describing PBC and similar concepts. Alternative terms include “performance based contracting” (PBC), “outcome based contracting” (OBC), “contracting for availability” (CfA), “contracting for capability” (CfC), “procurement of complex performance” (PCP), “performance based service acquisition” (PBSA), “pay for performance” (P4P), and “performance based logistics” (PBL). These terms are often used interchangeably, or applied in specific contexts, to emphasize the shifting emphasis towards buying and selling results and outcomes (Martin, 2007), even if there are exceptions (Ng & Nudurupati, 2010). Even if they are not considered to be synonymous, PBC is, at least, closely associated with concepts such as PSS and servitization (Baines et al., 2009; Neely, 2008).

There are several papers which reports on PBC in the defence sector (e.g., Berkowitz et al., 2004; Datta & Roy, 2011; Devries, 2004; Doerr et al., 2005; Essig & Batran, 2005; Fowler, 2008; Gansler & Lucyshyn, 2006; Geary et al., 2010; Geary & Vitasek, 2008; Glas & Essig, 2010; Kobren, 2009; Ng & Yip, 2009; Ng et al., 2009; Ng & Nudurupati, 2010; Nowicki et al., 2008; Nowicki et al., 2010; Randall et al., 2010; Randall et al., 2011; Sols et al., 2007, 2008; Vitasek et al., 2006; Vitasek & Geary, 2008). In the defence sector, PBL seems to be the most commonly used term, particularly in the United States (Fowler, 2008; Guajardo et al., 2012; Kim et al., 2007).

The term PBL was coined by the U.S. DoD in 2001 (Berkowitz et al., 2005; Devries, 2004; GAO, 2004). PBL is directed particularly towards logistics services for major weapons systems, and the purpose is to increase the performance, while maintaining, or reducing, the costs. PBL can be delivered by organic as well as commercial suppliers. The objective of PBL is to provide a contract structure that gives the supplier incentives to make investments in order 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. An important aspect of PBL is that the responsibility and risk taking in achieving the desired



result is transferred from the buyer to the supplier. At the core of PBL is a shift of paradigm, from transaction based defence equipment acquisition, to performance based defence acquisition.

To date, PBL has been used for a wide variety of contracts, including advanced platforms and complex, integrated technical systems in the United States; spares provisioning and system availability in the UK; and simulators for training systems in Norway (Ekström, 2013). Consequently, there is a wide variety in the practical application of PBL. There are also an increasing number of academic papers addressing the implementation of PBL in the defence sector. However, few of these papers take a service innovation approach to investigate how PBL generates value, or what types of value (performance) that is generated, from a buyer and a supplier perspective. This paper aims to contribute to the body of knowledge by taking a service innovation approach to investigate what types of value that is generated for thy buyer and the supplier.

For the purposes of this paper, that is, to emphasise the value generated for both end user and supplier, PBL is defined as

an outcome oriented strategy for integrated acquisition and sustainment of weapons systems. The purpose of the strategy is to enhance capability, availability and reliability from a lifecycle perspective. This is achieved through Performance Based Agreements and Contracts, with organic and commercial suppliers, which are based on long-term relations with the suppliers, include performance goals regarding the logistics support, and include appropriate incentives in order to generate value for the end user as well as the supplier.

The idea of performance has gained increased attention the last couple of years, especially in terms of specification and measurement (Buchanan & Klingner, 2007; Martin, 2005). However, there are still three generic problems with Performance Based Contracts: a “definition problem” (i.e., what to measure); a “measurement problem” (i.e., when, where and how to measure); and a “comparison problem” (i.e., with what to compare) (Ekström, 2012, p. viii). In addition, the terms “performance,” “profitability,” “productivity,” “effectiveness,” and “efficiency” are often not defined, confused with each other, and/or used as synonyms (Tangen, 2005; van Weele, 2002, p. 258). In this paper, performance is considered to be a combination of effectiveness and efficiency (Mentzer & Konrad, 1991; Neely et al., 1996). In defence acquisition, effectiveness is often measured in four dimensions: speed, cost, quality, and contracted availability (Hambleton et al., 2005, p. 81), even if there are also other possibilities, such as flexibility and dependability (Slack et al., 2010, p. 40). Furthermore, efficiency is often equated with Value-for-Money (VfM) (Arrowsmith, 2010, p. 5). In this paper we define performance as a combination of effectiveness and efficiency, where effectiveness is measured in speed, cost, quality, and availability, and efficiency is measured in terms of value for money.

Performance evaluation can be conducted at different levels, for example, at the supplier level, where the financial performance can be assessed against specific indicators, or at the end-user level, where the service impact on beneficiaries can be assessed (Gates et al., 2004). Performance can also be evaluated at system, subsystem, and/or component level. At the highest level of aggregation, performance can be evaluated against different types of outcomes: “Operational Availability,” “Operational Reliability,” “Cost per Unit Usage,” “Logistics Footprint,” and “Logistics Response Time” (DAU, 2005, p. 2-4). The metrics used for evaluation of supplier performance should, predominantly, be objective. However, in order to give the system some flexibility, some metrics can be evaluated



subjectively by the end-user (DAU, 2005, p. 2-6). In this paper we focus on subjectively perceived performance, at the system level, at the buyer, suppliers and end users. The reason for focusing on a subjective evaluation is that we aim to explore the aspects of innovation rather than the aspects of performance.

## **Connecting Innovation to PBC**

The link between PBL and service management has been studied to some extent (Ng et al., 2009). However, few links exist between PBL and Service innovation, and this combination has rarely been discussed in academic studies (Caldwell & Howard, 2010). The development towards a service economy has been underway for several decades already, and has accelerated the last couple of most developed market economies.<sup>5</sup> From a defence industrial perspective, the estimated relative value of services increases, which is a result of the fact that most MoDs/DoDs, spend less money on platforms and more on services and outsourcing of services. In the authors' view, this growth not only reflects the importance of services, but highlights the key role service innovation has to play in the defence industry in the future. In our view, service innovation is directly linked to the combined trend of ongoing outsourcing,<sup>6</sup> which now includes all phases of a military capability life-cycle and all Defence Lines of Development, and PBL, which promises to be advantageous for public sector buyers as well as for private sector suppliers.

From a corporate perspective, the aim of innovations is mainly to deliver increased efficiency and productivity as well as access to new markets and clients (Ozdemir et al., 2007). Linked to this overarching aim, there are also countless operational targets a firm might pursue by innovating, for example, the improvement of quality, decrease of costs, increase in speed and flexibility, extension of know-how, as well as social goals (Pleschak & Sabisch, 1996), which are also in line with the expected outcomes of PBL.

Relatively little is known about service innovation within PBC and how value is generated in the defence sector. A partial explanation is that it is a complex topic to obtain data on a politically sensitive subject such as the acquisition and outsourcing of military capabilities (Willet, 2009).

In our research framework we combine different aspects from PBC and service innovation. From PBC we take the dimensions of performance, that is, speed, cost, quality, contracted availability, and value for money. We also take the core aspects of risk transfer, reward sharing mechanisms and incentives into the framework. From service innovation we adopt the four dimensions of innovation in products, processes, position and paradigm. This provides us with a model for analysis to explore the perceived value among the involved actors.

---

<sup>5</sup> For a good review of the various views on services and service innovation, see Hauknes (1996).

<sup>6</sup> As explained by Toivonen (2004) in detail, this growth of (especially knowledge intensive) business services is due to ongoing specialization processes in combination with increased outsourcing of service activities on the one hand and autonomous growth of business services on the other.



## Context and Methodology

Service innovation in PBC is both complex and context bound, so an in-depth explorative case study research strategy was chosen as the best-suited research method (Miles & Huberman, 1994; Voss et al., 2002; Yin, 2003).

The Swedish defence sector was selected as the research setting for several reasons. The research topic is centred on the outsourcing of military capability in a long term commitment. The research also focuses on product and service interaction. The Swedish defence sector is currently undergoing considerable changes, which means that the challenges of PBL and value creation are discussed at all levels. An industry level analysis was proposed for this exploratory study, since it was considered to be important to gain data from multiple sources in the defence supply chain, including end users, defence buyers and the industrial suppliers, in order to obtain a comprehensive view of the interactions between PBC and Service innovation.

Prior to launching the in-depth case study the authors conducted a pilot study that involved eight exploratory interviews, which helped to refine the research questions and increase the general understanding of the ongoing changes within the defence sector and how it affected defence acquisition and the traditional way of thinking of management. In particular, the pilot study raised the importance of the emerging concept of Public Private Cooperation and PBC and the associated challenges experienced in the defence industry.

The main body of the interviews were conducted at organisations in the Swedish defence sector in order to gain a variety of perspectives. Consequently interviews were conducted within the SAF, FMV, the Swedish MoD, and at the service provider Saab. In total, 49 semi-structured interviews were conducted. Some key respondents were interviewed up to three different times over a period of several years. Each interview lasted on average one hour. A protocol of open-ended questions was prepared for the interviews, as a means for structure as well as stimulating discussions around the research questions.

Some of the respondents were known to the authors and a snowball sampling (Robson, 1997) was used for identifying and gaining access to appropriately informed respondents. This technique helped us to gain access to a range of key respondents within the SAF, FMV, MoD, and Saab.

Triangulating the data sources by using respondents from different functional areas and hierarchical levels (including customers), as well as external and internal documents, allowed for increased internal validity (Yin, 2003).

Interviews summaries were read and annotated providing a first level coding (Miles & Huberman, 1984) and data from the interviews were then complemented with secondary data such as governmental white papers (Lincoln & Guba, 1985). Matrices were produced based on the coding of the interview texts (Miles & Huberman, 1984) to compare viewpoints across the respondents, but also to identify themes in the exploration of the PBL and service innovation concepts. For confidentiality reasons, the results are presented in an anonymous format, where it is only possible to distinguish between the defence service buyers and service providers as categories, not individuals. The analysis for this paper was performed based on the two research questions presented earlier. The first question addresses what type of outcome or value the PBC rendered according to the actors involved. The second question addresses how the different types of value were generated. Here we used the defence acquisition process (CADMIT), the selected service innovation dimensions, and the selected aspects of PBC/PBL to inform the coding.





## Case Description

### ***Performance Based Logistics in the Swedish Defence Sector***

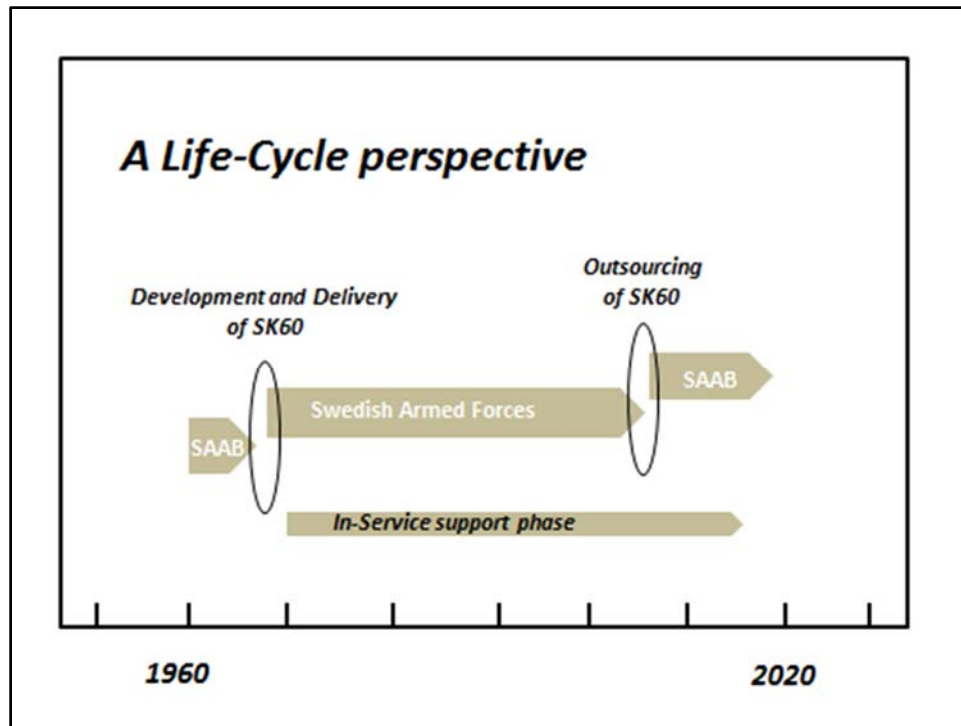
PBL is considered to be one out of several tools to manage the increasing outsourcing of services from the MoD to private service providers, in order to increase the overall efficiency and effectiveness, in the Swedish defence sector. Because of decreasing defence budgets, military capabilities based on advanced platforms are expected to remain in service longer in the future. As a consequence, novel ways of addressing, for example, Maintenance, Repair and Overhauls (MRO) of ageing systems, where the risk of obsolescence and lack of spare parts are essential parts of the equation, are required. By using PBL, with inventive risk and reward sharing mechanisms and incentive schemes, service providers are invited to take on a large part of the responsibility for the system until its Out-of-Service Date (OSD).

### ***The Saab 105 Trainer Aircraft (SK 60)***

The Saab 105 trainer aircraft, mostly known as the SK 60 in the Swedish Armed Forces, is the official name of the aircraft that is used to train military fighting pilots. Saab started the development 1959. The aircraft was taken into operation in SAF for the first time in 1963, and Saab subsequently delivered 190 aircraft, between 1966 and 1972, to the SAF. Since then, the aircraft have been operated and supported by the SAF the last 4 decades. In the beginning of the 21st century, the need for flight hours decreased, from 20,000 to 5,000 hours per annum, due to the downsizing of the SAF, and several air wings were consequently closed down. At this point in time, the support and services for the SK 60 were partly already outsourced, and were operated by private service providers such as Saab and Bromma Air Maintenance (BAM). At this time, all the involved stakeholders felt that something had to be done, since the cost for the remaining flight hours would be extremely high with the existing concept. 2006 A process started among the stakeholders, that is, the service provider Saab, the SAF, and FMV, to try to find out a new way of handling the SK 60 training of pilots to include the support and services.







**Figure 1. A Life-Cycle Perspective of the Saab Aircraft 105 (SK 60) Related to the In-Service Support Phase**

*Note.* This figure was developed by the authors.

Saab was awarded the contract through a Special Purpose Vehicle (SPV), and Saab 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 stated to be: “(i) establish a more cost effective way of operation, (ii) accomplish increased flexibility and scalability, (iii) reduce risks, (iv) accomplish increased certainty.”

The total value of the contract is 875 million SEK (Swedish Krona), which is roughly 135 million USD. The contract guarantees 6,500 flight hours per annum, on four separate locations in Sweden. In addition, the contract also includes Team 60, which is a flight parade team.

## Findings

The findings are presented in two subsections, corresponding to the two research questions. The findings should be regarded as preliminary and illustrative, since the analysis is currently in its final stages.

### ***What Types of Values Are Generated?***

The findings addressing the first research question are divided into three subsections. The first subsection presents findings regarding the perceived value the buyer’s perspective, whereas the second subsection focuses on the supplier perspective. The third subsection collects findings that do not fit the research questions, but which are interesting nevertheless.

### ***Perceived Value From the Service Buyer's Perspective***

A common view among the respondents from the buyer is that the most important value generated is that they now have 95% availability of the SK 60, which is considered to be a significant improvement. However, it should be remembered that, considering the 75% decrease in flying hours, and the corresponding reduction of operating platforms, this should not have been difficult for the Armed Forces to achieve in-house, since there are now several platforms to cannibalise, and/or use as immediate substitutes when the operational platforms require MRO.

The cost has been reduced by 30% through the contract. However, and rather surprisingly, relatively few of the respondents regard this as one of the most important values delivered by the PBC. In fact, some of the respondents even claim that this is something that the SAF could have managed if they had kept operations and maintenance in-house.

Respondents within FMV and the SAF HQ agree that they now, because of the PBC, have a very 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 a fringe benefit of this PBC, which is basically the first of its kind in Sweden, is the increased knowledge regarding how to contract for availability and how to engage in PBC.

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; the respondents feel that they have to pay more than what they should.

The issue of trust is also brought to attention. A problem for Saab was that they didn't succeed to deliver the retrofit of the new avionics system in time. This has caused irritation, especially among the end users, who have experience disturbances in their scheduled training.

### ***Perceived Value From the Service Provider's Perspective***

According to the respondents at the service provider, the most important value is the increased capability to deliver what they refer to as "Turnkey solutions," that is, to deliver PBC. The implication for Saab is that they now have a reference project, which they market, and, as several of the respondents indicate, which has already generated new PBC for other areas and systems, which is in line with Saab overall strategy.

From a back office planning perspective, it is now easier to administrate the system compared to previous, thus indicating an increased simplicity and less administration. There are no longer any requirements for indexing and monitoring of spare parts, or calculations of labour hours, and so forth.

### ***Other Findings***

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 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 left 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 PBC, the air craft 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 SAF.

There are also many other findings from this case study. The analysis provides additional evidence to support the prevalent view, that is, that the defence sector tends to focus on R&D, rather than any other aspects of innovation. In terms of flexibility, the end-users experience the aircraft now to be a part of a civilian 9 to 5 system, not a part of an operational military system. As a consequence, sorties now require much more planning in advance.

### ***How Are Values Created?***

The second research question is addressed by using the selected dimensions of service innovation (i.e., concept, processes, position and paradigm), and the steps of the CADMIT process, in order to answer how values are created in the SK 60 project.

The research indicates that, in this project, intentional value generation is, at least to a large extent, limited to the initial phases of the CADMIT process, and especially to the development of the service concept, whereas the later stages of the process are neglected, from a value generation perspective. There are certainly evidence of value creation activities also in the later stages, but these are predominantly of an ad hoc nature, and are focused of problem solving, or “trouble shooting,” on a day to day basis. Deliberate co-creation of value lies primarily in the early stages.

In order to generate value in the SK 60 project, which can be regarded to be a pilot project when it comes to Swedish PBC, the respondents from the SAF state that they needed to implement new ways of doing business, and even required a cultural change in the established defence acquisition routines. According to several of these respondents, a premier enabler for value generation was the fact the establishment of an Integrated Project Team (IPT), which was set up with stakeholders from the SAF, FMV and Saab. The IPT conducted “brain storming” meetings in order to generate ideas regarding how to find better and cheaper solutions to operate the SK 60 system. No formal, already existing, service development process was used for this purpose; neither did they include any outside stakeholders. The representatives from the three organisations were officers and technicians, and, as one of the officers said, “We know the system from inside out, we used our experience from the field to develop and suggest possible new solutions.” The value was mainly generated by changing three major aspects of the overall system. First of all, the number of operating aircraft was reduced by 50%. Secondly, the number of operating bases was reduced. Finally, the logistical support system, including fleet management and inventory management, was reorganised. These changes indicate the process innovation in several of the DLoDs.

In order to increase effectiveness and efficiency, Saab has redesigned its value system, including entering into new relationships with new business partners, that is, actors involved in jointly co-producing service innovation and providing the service to the SAF. The



most important partner is the sub-contractor Bromma Air Maintenance (BAM), which is responsible for first line maintenance at the bases. BAM is the partner in the value system which, on a daily basis, faces the SAF end users. BAM entered the scene when Saab required competence to set up the new delivery system. In addition to acquiring new skills, Saab also changed its organisational structure behind the new service concept, which affected the set up around the infrastructure at the main operating bases, such as inventory, hangars and building for new labours, and so forth.

The most important innovation in the SK 60 case can be regarded as the PBC and the service concept in itself. The research illustrates that the PBC challenges the traditional way of acquiring military capability, since it change the roles, the responsibilities and the interface between the actors involved. The contract was awarded to Saab as the Prime-contractor, with the entire responsibility for operation and maintenance of SK 60, and the SAF was reduced to a user of flight hours. This gave Saab the opportunity to change several aspects of the system. As a new form of contract, PBC opens up for many new opportunities. However, this requires a new mind-set within the Swedish defence sector. This is close to what Bessant and Davies (2007) define as paradigm innovation, which implies a change in the mental model regarding how to do business. The PBC also includes another dimension, namely the imbedded revenue model, which has been changed from a product-based revenue model, to a customised, service-based revenue model, where costs and profits are associated with client-specific, service contracts, rather than with selling machines.

The SK 60 project has challenged the SAF, FMV and Saab regarding how they do business. The SK 60 project is considered to be successful, and several positive aspects of the contracts have been identified, even though there are certainly also some negative aspects, especially when it comes to the perceived value among the end users. There are indications of process innovation, as well as paradigm innovation, in the contract. However, value is predominantly generated in the initial phases, such as concept development. Consequently, there is certainly ample opportunity for innovation in the later stages of the project's lifecycle.

The aim of the reported research was to explore the understanding of service innovation in a complex defence acquisition projects in the Swedish defence sector. The selected case was the outsourcing of the Saab 105 jet trainer air craft, or the SK 60, in a Performance Based Contract (PBC). The following research questions were formulated to guide the exploratory research project: "What types of values are generated in the PBC from the respective perspectives of the buyer and the supplier?" and "How are these different types of value generated?"

The research has indicated that the Swedish defence sector is much more likely to focus on R&D, rather than on any other type of innovation. Furthermore, the study indicates that innovation is still viewed as technology insertion, and still has a strong connection to the platform, and capability enhancement in terms of technological advancements.

The research has also revealed that there is an emerging requirement to complement the existing process for product development with a formal process for service development, and that this should focus also on the later stages of the CADMIT process, for example, in-service support. There is recognition among the involved that the PBC represents a need for new skills, as well as a cultural change, in order to fully exploit the potential of service innovation in the Swedish defence sector.



## **Theoretical Implications**

Howard and Caldwell (2011) argue that the defence community must view beyond the traditional context of new product development and instead encourage innovation at every stage of the lifecycle, including aspects such as platform upgrades and continuous improvement throughout the in-service stage. Our research supports this view, but adds another dimension; service innovation must not only focus on equipment and support, but also on all other components of capability. It is not until this entire spectrum of capability is addressed, from a lifecycle perspective, that service innovation will reach its full potential in the defence context.

## **Implications for Policy and Practice**

The research raises an important discussion about the meaning of service innovation to MoD buyers of performance and their supplying counterpart. The main implication for practice is the need for a new strategy and business model, which emphasises the aspects of servitization and bridges the gap to any existing policy for product development.

Another result of the research is that the understanding of value in the public sector is too constricted, and needs to be expanded. The political rhetoric “fast, cheaper, better” has found a firm foot-hold in defence acquisition, but the value aspects speed, cost and quality must be balanced with the other value aspects, for example, flexibility and dependability. First and foremost, however, value must also be extended to the perceived value of the end-user, and not only focus on the readily available measure of performance in acquisition project management. At the end of the day, the performance of the supplier is experience by the end-users. Consequently, the perceived value at the end-user should be an important aspect of any PBC.

The SAF and FMV are guided by the Strategy for Public Private Cooperation since 2006, and the defence materiel acquisition strategy since 2007. Based on the implications in this research project, it is evident that the SAF and FMV now require a new strategy, an integrated defence logistics acquisition strategy, which embraces all aspects of all components of logistics capability, from a lifecycle perspective, regardless if the supplier is organic or commercial. In order to be able to produce and implement such an integrated strategy, the research indicates that the level of skills, competence and capability among individual staff at the SAF, as well as within FMV, has to be elevated to new heights.

## **Limitations and Future Research**

In parallel with the reported research, the SAF and FMV has been undergoing an far-reaching restructuring of the Swedish defence logistics, where roles, responsibilities, and resources have been transferred from the SAF to FMV to a large extent. The restructuring has been planned by a special project group, with top-level participation from both organisations. The project group has identified and reported on many challenges related to how military capabilities should be developed, acquired and delivered. From the perspective of the co-creation of value, especially the existing inadequate interface between SAF and FMV on the one hand, and the interface between FMV and the industrial suppliers on the other hand, are of great concern, since areas of responsibility and roles among the actors need to be more distinct and understandable in order to succeed with co-creation of value on a long term basis.

A possible extension of this research could entail a multiple industry perspective. The findings demonstrate the utility of adopting a service perspective of innovation to acquire/deliver performance in terms of availability in the Swedish defence sector. At





present, the presented results of the research are, perhaps, nation-specific. By including more cases, and the perspectives of other nations, it may be possible to generalise the results to a greater extent, and thus also enhance the theoretical contribution. As it is, the contribution of the research is most likely to be of interest to defence acquisition practitioners in small and medium sized countries.

When exploring a dynamic process over long time, such as innovation in PBC, adopting a longitudinal method gives valuable insights. 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 PBC, as well as tracking potential for service innovations in later phases of the CADMIT-process, are needed to further develop the themes explored in this research.

## References

- Amara, N., Landry, R., & Doloreux, D. (2009). Patterns of innovation in knowledge-intensive business services. *The Service Industries Journal*, 29(4), 407–430.
- Arrowsmith, S (2010). *Public procurement: Basic concepts and the coverage of procurement rules*. In Arrowsmith, S., Treumer, S., Fejø, J., and Jiang, L. (2010). *Public procurement regulation: An introduction*, The EU Asia Inter University Network for Teaching and Research in Public Procurement Regulation, UK.
- Arrowsmith, S. (2011). Public procurement: Basic concepts and the coverage of procurement rules. *Public Procurement Regulation: An Introduction*, 1–32.
- Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A literature review and reflection on future challenges. *Journal of Manufacturing Technology Management*, 20(5), 547–567.
- Baines, T., Lightfoot, H. W., Evans, S., Neely, A., Greenough, R., Peppard, J., & Tiwari, A. (2007). State-of-the-art in product-service systems. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 221(10), 1543–1552.
- Berkowitz, D., Gupta, J. N., Simpson, J. T., & McWilliams, J. B. (2004). Defining and implementing performance-based logistics in government. *Defense Acquisition Review Journal*, 11(3), 255–267.
- Berggren, U., & Bergkvist, T. (2006). *Industriföretagens Serviceinnovationer*, NUTEK, Verket för näringslivsutveckling. Stockholm, Sweden.
- Bessant, J., & Davies, A. (2007). *Managing service innovation*, in UK Department of Trade and Industry (DTI) (2007). *Innovation in Services*, DTI Occasional Paper No.9, Department of Trade and Industry (DTI), UK.
- Bessant, J., & Maher, L. (2009). Developing radical service innovations in healthcare—The role of design methods. *International Journal of Innovation Management*, 13(04), 555–568.
- Bracken, P., Brandt, L., & Johnson, S. E. (2005, July). The changing landscape of defense innovation. *Defense Horizons*, 47.
- Buchanan, N., & Klingner, D. E. (2007). Performance-based contracting: Are we following the mandate? *Journal of Public Procurement*, 7(3), 301–332.
- Caldwell, N. & Howard, M., Editors. (2011). *Procuring complex performance—Studies of innovation in product-service management*. Routledge, Abingdon, UK.





- Carlborg, P., Kindström, D., & Kowalkowski, C. (2014). The evolution of service innovation research: A critical review and synthesis. *The Service Industries Journal*, 34(5), 373–398.
- Chae, B. K. (2012). An evolutionary framework for service innovation: Insights of complexity theory for service science. *International Journal of Production Economics*, 135(2), 813–822.
- Chamerlin, T., Doutriaux, J., & Hector, J. (2010). Business succes factors and innovation in Canadian service sectors: An initial investigation of inter-sectoral differences. *The Service Industries Journal*, 30(2), 225–246.
- Chesbrough, H., & Schwartz, K. (2007). Innovating business models with co-development partnerships. *Research Technology Management*, 50(1), 55–59.
- Coombs, R., & Miles, I. (2000). Innovation, measurement and services: The new problematique. In Metcalfe, J. S. & Miles, I. (Eds.), *Innovation systems in the service economy*. Kluwer Academic Publisher, New York, NY.
- Datta, P. P., & Roy, R. (2011). Operations strategy for the effective delivery of integrated industrial product-service offerings: Two exploratory defence industry case studies. *International Journal of Operations & Production Management*, 31(5), 579–603.
- DAU. (2005). *Performance based logistics: A program manager's product support guide*. Fort Belvoir, VA: Defence Acquisition University (DAU) Press,.
- den Hertog, P., & de Jong, G. (2000). Randstad's business model of innovation: Results from an exploratory study in the temporary staffing industry. In den Hertog, P. (2000), *Managing service innovation: firm-level dynamic capabilities and policy options* (PhD dissertation). Faculty of Economics and Business, University of Amsterdam, Amsterdam, the Netherlands.
- den Hertog, P., Van der Aa, W., & de Jong, M. W. (2010). Capabilities for managing service innovation: Towards a conceptual framework. *Journal of Service Management*, 21(4), 490–514.
- Devries, H. J. (2004). Performance-based logistics-barriers and enablers to effective implementation. *Defense Acquisition Review Journal*, 11(3), 243–254.
- Dimond, D. (2006, April 25). Defence innovation internal and external factors. *RUSI Defense System*, 73.
- Dodgson, M., Gann, D., & Salter, A. (2006). The role of technology in the shift towards open innovation: The case of Procter & Gamble. *R&D Management*, 36(3), 333–346.
- Doerr, K., Lewis, I., & Eaton, D. R. (2005). Measurement issues in performance-based logistics. *Journal of Public Procurement*, 5(2), 164–186.
- Dombrowski, P. J., & Gholz, E. (2006). *Buying military transformation: Technological innovation and the defense industry*. Columbia University Press, New York, NY.
- Drejer, I. (2004). Identifying innovation in surveys of services: A schumpeterian perspective. *Research Policy*, 33(3), 551–562.
- Droege, H., Hildebrand, D., & Forcada, M. A. H. (2009). Innovation in services: Present findings, and future pathways. *Journal of Service Management*, 20(2), 131–155.
- Edvardsson, B. (1997). Quality in new service development: Key concepts and a frame of reference. *International Journal of Production Economics*, 52(1), 31–46.
- Ekström, T. (2012). *Public private business models for defence acquisition—A multiple case study of defence acquisition projects in the UK* (Licentiate thesis). Lund University, Sweden. Retrieved from



<http://lup.lub.lu.se/luur/download?func=downloadFile&recordId=3051798&fileId=3051805>

- Ekström, T. (2013). *Prestationsbaserad logistik—Ett paradigmskifte från transaktionsbaserad försvarsmaterielanskaffning till prestationsbaserad försvarsanskaffning (Performance Based Logistics—A shift of paradigm from transaction based defence materiel acquisition to performance based defence acquisition)*, FOI-R-3628—SE, Swedish Defence Research Agency (FOI), Stockholm, Sweden. Retrieved from [http://foi.se/ReportFiles/foir\\_3628.pdf](http://foi.se/ReportFiles/foir_3628.pdf)
- Essig, M. & Batran, A. (2005). Public–private partnership—Development of long-term relationships in public procurement in Germany. *Journal of Purchasing and Supply Management*, 11(5), 221–231.
- Essig, M., Glas, A., & Kleemann, F. C. (2014). PBL—ein lösungsansatz für die deutsche verteidigungsbeschaffung? In Essig, M. & Glas, A. (2014), *Performance based logistics*. Springer Fachmedien, Wiesbaden, Germany.
- Fowler, R. (2008). Performance based life cycle product support—the new PBL. *Proceedings of the North American Defence Logistics Conference*, Crystal City, VA.
- Gadrey, J., Gallouj, F., & Weinstein, O. (1995). New modes of innovation: How services benefit industry. *International Journal of Service Industry Management*, 6(3), 4–16.
- Gago, D., & Rubalcaba, L. (2007). Innovation and ICT in service firms: Towards a multidimensional approach for impact assessment. *Journal of Evolutionary Economics*, 17(1), 25–44.
- Gallouj, F., & Savona, M. (2009). Innovation in services: A review of the debate and a research agenda. *Journal of Evolutionary Economics*, 19(2), 149–172.
- Gallouj, F., & Savona, M. (2010). Towards a theory of innovation in services: A state of the art. In Gallouj, F., & Djellal, F. (2010), *The handbook of innovation and services—A multi-disciplinary perspective*. Edward Elgar Publishing Limited, Cheltenham, UK.
- Gallouj, F., & Weinstein, O. (1997). Innovation in services. *Research Policy*, 26(4), 537–556.
- Gansler, J. S., & Lucyshyn, W. (2006). *Evaluation of performance based logistics*. University of Maryland, Center for Public Policy and Private Enterprise, College Park, MD.
- Gates, L. B., Klein, S. W., Akabas, S. H., Myers, R., Schwager, M., & Kaelin-Kee, J. (2004). Performance-based contracting: Turning vocational policy into jobs. *Administration and Policy in Mental Health and Mental Health Services Research*, 31(3), 219–240.
- Geary, S., Koster, S., Randall, W. S., & Haynie, J. J. (2010). Performance-based life cycle product support strategies: Enablers for more effective government participation. *Defense Acquisition Review Journal*, 17(4), 450–483.
- Geary, S., & Vitasek, K. (2008). *Performance-based logistics: A contractor's guide to life cycle product support management*. Supply Chain Visions, Bellevue, WA.
- Glas, A., & Eßig, M. (2010). Public performance-based contracting: Outcome oriented pricing of incomplete contracts facing public procurement procedures and price law. *Supply Management, Missing Link in Strategic Management 2010 Proceedings of the 19th IPSERA-Conference*, Lappeenranta, Finland, May 16–19.
- Glas, A., Hofmann, E., & Eßig, M. (2013). Performance-based logistics: A portfolio for contracting military supply. *International Journal of Physical Distribution & Logistics Management*, 43(2), 97–115.
- Guajardo, J. A., Cohen, M. A., Kim, S., & Netessine, S. (2012). Impact of performance-based contracting on product reliability: An empirical analysis. *Management Science*, 58(5), 961–979.



- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of Qualitative Research*, 2, 163–194.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Lincoln, Y. S. (Eds.), *Handbook of qualitative research*. Sage Publications Inc., Thousand Oaks, CA.
- Hambleton, K., Kirkpatrick, D., Holder, I., Kimberley, D., Bragg, M., McNally, S., Weiss, A. & Williams, T. (2005). *Conquering complexity—Lessons for defence systems acquisition*. The Stationery Office (TSO), Norwich, UK.
- Howard, M., & Caldwell, N. (2011). Introduction. In Caldwell, N. och Howard, M. (Eds.), *Procuring complex performance—Studies of innovation in product-service management*. Routledge, Abingdon, UK.
- Howard, M., Miemczyk, J., & Johnsen, T. (2007). Exploring supply strategy and through-life management in the UK defence industry. *Supply Chain Practice*, 9(2), 34–53.
- Huberman, M., & Miles, M. B. (2002). *The qualitative researcher's companion*. Sage Publications Inc., Thousand Oaks, CA.
- Hypko, P., Tilebein, M., & Gleich, R. (2010). Clarifying the concept of performance-based contracting in manufacturing industries: A research synthesis. *Journal of Service Management*, 21(5), 625–655.
- Johnsen, T., Howard, M., & Miemczyk, J. (2009). UK defence change and the impact on supply relationships. *Supply Chain Management: An International Journal*, 14(4), 270–279.
- Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, 13(6), 343–373.
- Kim, S., Cohen, M. A., & Netessine, S. (2007). Performance contracting in after-sales service supply chains. *Management Science*, 53(12), 1843–1858.
- Kim, S., Cohen, M. A., Netessine, S., & Veeraraghavan, S. (2010). Contracting for infrequent restoration and recovery of mission-critical systems. *Management Science*, 56(9), 1551–1567.
- Kindström, D. (2010). Towards a service-based business model—Key aspects for future competitive advantage. *European Management Journal*, 28(6), 479–490.
- Kindström, D., & Kowalkowski, C. (2014). Service innovation in product-centric firms: A multidimensional business model perspective. *Journal of Business & Industrial Marketing*, 29(2).
- Kobren, B. (2009). What performance based logistics is and what it is not-and what it can and cannot do. *Defense Acquisition Review Journal*, 38(5), 254–267.
- Kuusisto, J., & Meyer, M. (2002). *Insights into services and innovation in the knowledge-intensive economy*, National Technology Agency, Helsinki, Finland.
- Lincoln Y.S, & and Guba, E.G. (2003) Paradigmatic controversies, contradictions and merging confluences. In N. K. Denzin & Y.s. Lincoln (Eds.), *The landscape of qualitative research*. Thousand Oaks: Sage Publications Ltd.
- Lindberg, N., & Nordin, F. (2008). From products to services and back again: Towards a new service procurement logic. *Industrial Marketing Management*, 37(3), 292–300.
- Martin, L. L. (2005). Performance-based contracting for human services: Does it work? *Administration in Social Work*, 29(1), 63–77.
- Martin, L. L. (2007). Performance-based contracting for human services: A proposed model. *Public Administration Quarterly*, 31(1/2), 130–158.



- Mentzer, J. T., & Konrad, B. P. (1991). An efficiency effectiveness approach to logistics performance analysis. *Journal of Business Logistics*, 22(1), 33–61.
- Miemczyk, H., & Johnsen. (2013). Exploring product-service supply dynamics in the defence industry (Chapter 9). In Essig, M., Glas, A., *Performance based logistics innovatives (beschaffungsmanagement fur die Streitkräfte)*. Springer gabler 2013.
- Miles, M. B., & Huberman, A. M. (2000). *Qualitative data analysis* (2nd ed.). Sage Publications Inc, Thousand Oaks, California.
- Molas-Gallart, J., & Davies, A. (2006). Toward theory-led evaluation the experience of european science, technology, and innovation policies. *American Journal of Evaluation*, 27(1), 64–82.
- Neely, A. (2009). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research*, 1(2), s 103–118.
- Neely, A., Mills, J., Platts, K., Gregory, M., & Richards, H. (1996). Performance measurement system design: Should process based approaches be adopted? *International Journal of Production Economics*, 46–47, 423–431.
- Ng, I. C., Maull, R., & Yip, N. (2009). Outcome-based contracts as a driver for systems thinking and service-dominant logic in service science: Evidence from the defence industry. *European Management Journal*, 27(6), 377–387.
- Ng, I. C., & Nudurupati, S. S. (2010). Outcome-based service contracts in the defence industry—Mitigating the challenges. *Journal of Service Management*, 21(5), 656–674.
- Ng, I. C. L., & Yip, N. (2009). Identifying risk and its impact on contracting through a benefit based-model framework in business to business contracting: Case of the defence industry. *Proceedings of the 1st CIRP Industrial Product-Service Systems (IPS2) Conference*, Cranfield, UK.
- Nowicki, D., Kumar, U. D., Steudel, H. J & Verma, D. (2008). Spares provisioning under performance-based logistics contract: Profit-centric approach. *Journal of the Operational Research Society*, 59(3), 342–352.
- Nowicki, D., Randall, W. S., & Gorod, A. (2010). A framework for performance based logistics: A system of systems approach. *2010 International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT)*, Moscow, Russia (681–692).
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160–172.
- Ostrom, A. L., Bitner, M. J., Brown, S. W., Burkhard, K. A., Goul, M., Smith-Daniels, V., & Rabinovich, E. (2010). Moving forward and making a difference: Research priorities for the science of service. *Journal of Service Research*, 13(1), 4–36.
- Randall, W. S., Nowicki, D. R., & Hawkins, T. G. (2011). Explaining the effectiveness of performance-based logistics: A quantitative examination. *International Journal of Logistics Management*, 22(3), 324–348.
- Randall, W. S., Pohlen, T. L., & Hanna, J. B. (2010). Evolving a theory of performance-based logistics using insights from service dominant logic. *Journal of Business Logistics*, 31(2), 35–61.
- Robson, C. (1997). *Real world research*. Blackwell, Oxford, UK.
- Rubalcaba, L., Gago, D., & Gallego, J. (2010). On the differences between goods and services innovation. *Journal of Innovation Economics*, 5(1), 17–40.
- Schumpeter, J.S. (1934). *The theory of economic development (Translation of Theorie der wirtschaftlichen Entwicklung, 1912)*. Cambridge, MA: Harvard University Press.





- Selviaridis, K. (2011). Performance-based contracting. State of the art and future directions. *Proceedings of the 20th Annual IPSERA Conference*, (127–143), Maastricht, the Netherlands.
- Slack, N., Chambers, S., & Johnston, R. (2010). *Operations management* (6th ed.). Pearson Education Limited, Harlow, UK.
- Smith, K. (2005). *Measuring Innovation*, in J. Fagerberg, D. Mowery & R. Nelson (Eds.) (2005). *The Oxford handbook of innovation*. Oxford University Press, New York, NY.
- Sols, A., Nowick, D., & Verma, D. (2007). Defining the fundamental framework of an effective performance-based logistics (PBL) contract. *Engineering Management Journal*, 19(2), 40–50.
- Sols, A., Nowicki, D. & Verma, D. (2008). Regular paper n-dimensional effectiveness metric-compensating reward scheme in performance-based logistics contracts. *Systems Engineering*, 11(2), 93–106.
- Sundbo, J., & Gallouj, F. (2000). Innovation as a loosely coupled system in services. *International Journal of Services Technology and Management*, 1(1), 15–36.
- Tangen, S. (2005). Demystifying productivity and performance. *International Journal of Productivity and Performance Management*, 54(1), 34–46.
- Tether, B. S. (2005). Do services innovate (differently)? insights from the european innovometer survey. *Industry & Innovation*, 12(2), 153–184.
- Tidd, J. (2006). *Innovation models*. Imperial College, London, UK.
- Tidd, J., & Bessant, J. (2011). *Managing innovation: Integrating technological, market and organizational change*. John Wiley & Sons.
- The UK Ministry of Defence. (2005). *Defence Industrial Strategy (DIS)—Defence White Paper*, UK. Retrieved from [http://www.mod.uk/NR/rdonlyres/F530ED6C-F80C-4F24-8438-0B587CC4BF4D/0/def\\_industrial\\_strategy\\_wp\\_cm6697.pdf](http://www.mod.uk/NR/rdonlyres/F530ED6C-F80C-4F24-8438-0B587CC4BF4D/0/def_industrial_strategy_wp_cm6697.pdf)
- The UK Ministry of Defence MoD. (2007). *Defense Innovation Strategy—Creating a new environment for innovation within the defence supply chain*. Retrieved from <http://www.science.mod.uk/strategy/innostrat.aspx>
- Tukker, A. (2004). Eight types of product-service system: Eight ways to sustainability? Experiences from suspronet. *Business Strategy and the Environment*, 13(4), 246–260.
- UK Ministry of Defence (MoD) (2005). *Defence Industrial Strategy (DIS)—Defence White Paper*, Presented to Parliament by The Secretary of State for Defence, By Command of Her Majesty (Cm 6697), December 2005. The Stationary Office (TSO), London, UK.
- Ulaga, W., & Reinartz, W. J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *Journal of Marketing*, 75(6), 5–23.
- Van Weele, A. J. (2002). *Purchasing and Supply Chain Management—Analysis, Planning and Practise, Third Edition*. Thomson Learning, London, UK.
- Van Weele, A. J. (2009). *Purchasing & supply chain management: Analysis, strategy, planning and practice, 5th Edition*. Cengage Learning EMEA, UK.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1–17.
- Vence, X., & Trigo, A. (2009). Diversity of innovation patterns in services. *The Service Industries Journal*, 29(12), 1635–1657.
- Vitasek, K., Cothran, J., Geary, S., & Rutner, S. (2006). *Performance-based logistics: The changing landscape in support contracting*. The University of Tennessee, Knoxville, TN.



Vitasek, K., & Geary, S. (2008). *Performance-based logistics redefines DoD procurement*. *World Trade*, 21(6), 62–65.

Voss, C., Tsikriktsis, N., & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management*, 22(2), 195–219.

Yin, R. K. (2003). Applied social research methods series. *Case Study Research: Design and Methods, Third Edition*. Sage Publications Inc., Thousand Oaks, California.

## Appendix A: Interviews

No.	Position	Organization	Interview date
<b>Pilot study Interviews</b>			
1	PPP-coordinator	FMV	80121
2	Manager **	SAF	80208
3	Director	SAF	80218
4	Business Developer ***	SAAB	80311
5	Project-leader	SAF	80319
6	Chief Scientist **	SAF	80320
7	Program- Manager **	FMV	80322
<b>Semi-structured Interviews</b>			
8	Defense Analyst	FOI	80511
9	Defense Analyst	SAF	90212
10	Manager	FMV	90409
11	Manager	SAAB	90412
12	Manager	SAAB	90412
13	Manager	FMV	90512
14	Manager	FMV	100423
15	Director Logistics	FMV	100423
16	Director Air	SAAB	100523
17	Dep. Program Manager	FMV	110903
18	Manager	FMV	110903
19	Product Developer Manager	SAAB	111204
20	Program Manag ***	SAAB	111204
21	Analyst	VINNOVA	120922
22	PPP-Manager **	SAF	121118
23	Director	FMV	121121
24	Previous Director	FMV	121122
25	Manager	FOI	121203
26	Manager	SAAB	121206
27	PPP-manager	SAAB	121206
28	PPP-manager **	SAAB	121215
29	Manager	FMV	121217
30	Program Manager **	FMV	121218
31	Previous PPP-Manager	MoD	121220
32	Controller	MoD	130114
33	Controller	SAF	130117
34	Material System Developer	SAF	130619
35	Maintenance- Officer	BAM	130827
36	Program Manager	SAAB	130827
37	Maintenance Manager	FM	130827
38	Maintenance Manager	BAM	130828
39	Manager	SAF	130828
40	Flight School	SAF	130828
41	Flight School	SAF	130828
42	General Director	SOFF	130906





43	Director	SAAB	130909
44	Defense Analyst	SOFF	130922
45	R&D Manager	SAF	130930
46	Dep. Program officer	FMV	140321
47	Project Manager	SAF	140321
48	Business Development Manager	SAAB	140328

*Notes.*

VINNOVA: Swedish Governmental Agency for Innovation Systems

SOFF: Swedish Security and Defense Industry Association

FOI: Swedish Defence Research Agency

\*= Number of interviews more than one

**Appendix B: Semi-Structured Interview Guide**

*RQ 1 What types of values are generated in the PBC from the perspectives of the buyer and the supplier?*

What aspects of outcome has been generated by the PBC

What aspects of value can you define?

Who have gained value of the PBC?

Are there some negative aspects related to outcome of the PBC?

*RQ 2 How are these different types of value generated?*

How are innovation, valued, generated, interpreted, and understood?

Do people here create ideas on their own?

Do people here create good ideas by working across the agency?

Do you source ideas from the outside?

Is it easy to fund new ideas?

How is ideas turning into viable products/services, businesses?

How are ideas diffused across the company?

How is change created?

How is value created?

How is novelty created?





ACQUISITION RESEARCH PROGRAM  
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY  
NAVAL POSTGRADUATE SCHOOL  
555 DYER ROAD, INGERSOLL HALL  
MONTEREY, CA 93943

[www.acquisitionresearch.net](http://www.acquisitionresearch.net)