

Performance-based Contracting in the Defence Industry: Exploring Triadic Dynamics between Government, OEMs and Suppliers

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Abstract

This study takes a rare longitudinal perspective to examine performance-based contracting (PBC) in the context of the development of a major capital defence project. It employs a triadic framework to examine changes in actors and their roles over time in fulfilling the project. The triads involve both contractors as suppliers and government entities. More specifically, using a historical narrative method the study suggests that over the 30 year span of the new warship's development, different parties occupy the nodes of triads where the roles or functions of the principal and agents in the contract change over time. Our use of a triadic perspective enables us to trace both the withdrawal of the government customer from a position of authority and the specific strategy of one supplier to occupy the vacated role as systems integrator. The study makes three distinct contributions: firstly, to our understanding of PBC through tracing the development of the conditions that enable PBC in largescale long-term public-private contracting such as clear role delineation. Second, it adds to understanding of principal-agent behaviour in triadic public-private projects, suggesting that customer and supplier roles need to be perceived as supply network dynamics. Third, it suggests reasons why this defence acquisition underperformed, focusing on the mediation of the customer's value requirement through powerful players seeking to extend their control. We argue PBC must be re-assessed in complex environments to include less direct financial measures such as long-term market share and adopt a more nuanced approach to contractual management than simply transferring risk.

Keywords: Principal-agent, PBC, supply networks, historical narrative, evolution, triads

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1. Introduction

Public procurement has garnered considerable attention from academics and practitioners over the past decade, particularly the performance of public-private capital projects (Thai, 2001; Davis and Hobday, 2005; Essig and Glas, 2014; Roehrich *et al.*, 2014; Jones and Hollinger, 2016). Such projects require new forms of contractual design and management that can transfer risk to the private sector whilst providing auditable public value. Selviaridis and Wynstra (2015) identify much of the surge of interest since 1989 in Performance-based Contracting (PBC) as linked to managing largescale public-private projects, such as the commissioning of defence platforms.

The same authors argue that the essence of PBC is *‘the contractual approach of tying at least a portion of supplier payment to performance’* (Selviaridis and Wynstra, 2015: 3505). As a contractual mechanism it works by specifying predetermined outcomes as overall service capability, rather than discrete assets or equipment delivered on the basis of static product-based specification (Heinrich, 2002; Caldwell and Howard, 2011). Public procurement that requires substantial input from the private sector involves three key parties: the government agencies who initiate and manage the contract, the customers or users of the product or service, and the product or service suppliers (Tate *et al.*, 2010; Wynstra *et al.*, 2015). During an extended contract fulfilment period the specific roles of all three parties may change at different phases of the project. Furthermore, because the customers are multi-stakeholders with different priorities, the definition of performance may also change, further complicating supplier performance evaluation. This dynamic challenges agency theory when used to monitor the behaviour of suppliers, where the principal and agent are assumed to remain the same and critically, fulfill the same role throughout the contract fulfilment period (Ross, 1987; Eisenhardt, 1989).

In this study we explore the underperformance of one such project which utilized PBC in a UK maritime defence supply network, and link that failure to the changing roles of principals and agents over an extended, multi-decade period. Our aim is to explicate the agency issues in government procurement and the use of agency theory in managing complex government contracts. We ask, **RQ1:** How do the patterns of interaction and principle-agent roles evolve over time in complex defence procurement? **RQ2:** What does agency theory and triadic dynamics contribute to our understanding of the conditions necessary for PBC? **RQ3:** Why did PBC underperform in this type of extended government contract?

Our investigation focuses on a new warship commissioning project spanning 30 years. Defence procurement and supply structures in the 1980s consisted of UK government agencies including state-owned manufacturing facilities, and defence component and assembly firms. By design, a government uses dual sourcing or parallel sourcing to stimulate competition and retain supply options to protect the long-term capability of its defence industry. Yet post-cold war military cutbacks and subsequent industry consolidation particularly in the UK and USA has meant fewer firms from which government buyers in the west can make their selection (Geary and Fowler, 2014; Caldwell and Howard, 2014). Unlike most contracts in the private sector that involve two parties (i.e. buyer-supplier), defence contracts for complex new platforms can be conceived as a triadic arrangement: government agencies, general contractors (OEMs) and suppliers. During the associated extended contract fulfillment period, actual members of the triad may adapt by taking different roles over time or change completely at different phases of the contract. Several interesting lines of enquiry are raised here on agency issues: how the government as principal manages the agents (i.e. OEMs) when the actual actors of the principal change as the project progresses, and as a consequence, the implications for PBC under such conditions.

The recent emergence of the prime contractor as a distinctive third player in major civil and defence projects, otherwise termed as a systems integrator or contract manufacturer, creates a new supply contracting arrangement with significant implications for PBC (Davies *et al.*, 2007). We use agency theory supported by a triadic framework to illuminate a series of critical stages during a major warship construction programme (Obstfeld, 2005; Choi and Wu, 2009; Wu *et al.*, 2010), including capturing the changes over time to the principal-agent's role and position in the supply network. By analyzing these arrangements, we are able to gain insight into firm strategy and inter-organizational relationships in the context of how supply networks evolve to complete a complex contract. We argue that to understand PBC in such projects it is necessary to consider agency in the context of the maneuverings by all parties as the roles of principal-agent change over the contractual timeframe. Applying the consequences of behaviour such as covert control-seeking (e.g. Tate *et al.*, 2010) improves our understanding of the efficacy of PBC in managing complex government contracts.

Our key findings offer some challenges to the theoretical answers provided by buyer-supplier relationship informed agency theory. Although PBC appears to include mechanisms to transfer risk to suppliers, complex procurements such as our study suggest suppliers or contractors are not necessarily the inert recipients of risk transfer, and will actively exploit structural gaps left by public agencies. Such dynamics create tensions and new connections in the network, which in turn affects performance. Hence PBC needs to take a more nuanced and iterative approach to risk transfer, capable of adapting and responding to iterations of opportunist supplier behaviour over extended periods of time.

In the next section we examine the literature on PBC, agency theory and triadic dynamics. Then we present our methodology in section 3, and the findings of the study in section 4. Finally we present our discussion & analysis in section 5, before concluding with theoretical contributions.

2 Performance-based contracting, agency theory and triadic dynamics

The literature review contains two sections. First, general assumptions regarding performance-based contracting are examined, including the temporal dimensions and agency issues in complex contractual arrangements. Second, the role of principal-agent in triadic dynamics is used to highlight the challenges and efficacy of PBC in supply networks.

2.1 General assumptions and dimensions of PBC

Agency or ‘principal-agent’ (P-A) theory helps our understanding of the purchase of complex products and services because of the inherent assumption that the interests of principals and agents diverge (Eisenhardt, 1989). Principal agents can limit divergence by establishing appropriate incentives for the agent and by implementing *ex ante* measures such as monitoring which limit opportunistic actions by the agent (Hill and Jones, 1992). In PBC, particularly the procurement of defence equipment and services, the extended nature of commissioning which often spans decades and the complexities of sub-contracting constituent parts means there is considerable opportunity for divergence from the original objectives (Caldwell and Howard, 2011; 2014). The concept of PBC emphasizes the specific payment mechanisms for capital goods and services that are to be delivered (Ng *et al.*, 2009), and the strategic evaluation of the suppliers’ potential revenue generation from such investments (Sols *et al.*, 2007). The main goal of PBC, derived from the theoretical assumptions of the principal-agent dilemma, is to align the suppliers’ performance to the customers’ requirements (Kim *et al.*, 2007). Increasingly customers or buyers tend to purchase the utilization or performance outcomes of products, rather than the ownership of the products themselves as capital goods (Ng *et al.*, 2009). Such transactions determine the payment structure and risk allocation associated with these products and services. Hence the risk allocation between suppliers and buyers is very closely linked to the development of payment schemes in the form of penalties and bonuses (Hooper, 2008; Selviaridis and Norrman, 2014). For example, instead of dumping risk on contractors during the construction of Terminal 5 at Heathrow airport as per traditional arms-length contracting, client British Airways Authority decided to bear the overall project risk itself, reimbursing incurred costs and creating an integrated project team approach with a system of positive rewards for results (Brady and Davies, 2011). In this context, procuring complex performance recognises the challenges posed by largescale projects, where *‘the bundling of product and infrastructure with long-term, often multi decade service support requirements, a combination which produces a number of significant operational and supply decisions, namely through-life management...risk modelling [and] new forms of contractual control’* (Howard and Caldwell, 2014: 146).

The contracting relationships literature addresses buying products or services with the intention to add value to either the producers, customers or the government, depending on the supply chain position where the purchasing activity takes place. Service contracts are usually based on the cost structure of the input materials or services for a desired production process or service (Lindberg and Nordin, 2008). Such a conventional approach, where contractual agreements are based on value-adding potential, is essentially static and does not address dynamics in changing customer requirements. This may be problematic in PBC scenarios involving long-term projects where it is likely that performance requirements will change over time. The trend towards bundling strategies which combine products and services (Stremersch *et al.*, 2001, Davies *et al.*, 2007) introduces contracting which may become overly complex because of the number of suppliers involved. Tate *et al.*, (2010: 813-814) argue that with the rise of procuring increasingly complex business services, supply management professionals are getting involved with marketing specialists to facilitate relationships with suppliers. Identifying these relationships as triadic, they claim complex purchases require '*a hybrid contract type that combines elements of both behaviour-based and outcome-based contracts...to reduce conflict*' and acknowledge the importance of identifying hidden or covert supplier behaviour during support phases.

The temporal dimension of PBC is introduced by Kleemann and Essig (2013) who state that any additional costs during service support activities such as maintenance and repair are traditionally not considered in the initial purchasing contract for industrial or commercial products. They argue that suppliers might be inclined to provide faulty capital goods or services deliberately to generate more revenue over time. These contracts may also include the provision of a 'cost-plus' agreement to provide the option for buyers to pay additional reimbursements in the event of an unexpected change in service level (Kim *et al.*, 2007, Ng *et al.*, 2009). Lifecycle costing therefore is critical in PBC and underlines the importance of establishing a common agreement on who is responsible for support costs at the initial contracting and negotiating phase. PBC focuses on the results and performance outcomes of a contractual relationship rather than the evaluation of initial inputs and processes (Martin, 2007). As a result, suppliers cannot ignore the importance of providing through-life support for products and services, and must fully understand the implications to their business of performance outcomes as defined by the customer (Windahl and Lakemond, 2006; Brax and Jonsson, 2009).

In the context of large-scale procurement and supply network relationships, the buyer collaborates closely with the OEMs from the outset. These relationships change the perspective from a goods-based towards a more service-based approach (Ostrom *et al.*, 2010). In procuring complex long-term projects (e.g. warships, airport terminals, hospitals) the mode of value creation changes from product based to a product-service solution (Araujo and Spring, 2006; Brady and Davies, 2011). Contractors are often no longer willing to undertake capital-intensive investments into machinery or equipment, and decide to outsource these operations. As a result sub-contractors are emerging in

different industries that close the gap between pure manufacturing and service offerings by developing PBC relationships through service integration (Hypko *et al.*, 2010). Such relationships often resemble an alliance type structure, where performance requirements are defined upfront, and the risks and cost are shared jointly by public and private sector organizations (Caldwell and Howard, 2011). These arrangements require the elucidation of targets (e.g. cost, delivery, availability) with formal incentive payments agreed by contract, yet with sufficient flexibility for *ad hoc* innovation and ‘room for manoeuvre’ in case of unexpected events. To reach their performance targets, recent cases have tended to display characteristics closer to the spirit of a commercial venture heavily dependent on outsourcing, than more conventional arrangements where control is directed through the buying organization (Caldwell and Howard, 2014).

The strong focus on performance outcomes in PBC relationships is derived from expected customer value, including soft factors such as customer satisfaction, and determines the level of value creation (Bonnemeier *et al.*, 2010; Selviaridis and Norrman, 2014). Expected value and performance specifications must be constantly evaluated, with any uncertainties closely linked to the allocation of risk in the payment scheme. Instances involving risk transferability, therefore, should in theory only occur in mutually close relationships, where a high level of trust already exists and communication between partners is maintained for the duration of the contract (Kleemann and Essig, 2013). One explanation is that mutual trust conducted via a collaborative venture or alliance is the primary basis for risk transfer in PBC relationships (Hypko *et al.*, 2010). Underpinning risk is the assumption that outcome-based contracts increase the level of strategic dependency on suppliers (Buse *et al.*, 2001). The risks associated with dependency are often less than the possible advantages of a strategic relationship (Cousins and Lawson, 2007). Mutual goals can be aligned by outlining the characteristics and performance requirements *a priori* to the contractual buyer-supplier relationship (Han *et al.*, 1993), resulting in closer, more trustful strategic relations. Such arrangements can be difficult to maintain over longer periods, however, and are susceptible to instabilities in the external socio-political environment, lack of goal congruence and conflicting motives of principal agents. Selviaridis and Wynstra, (2015) suggest two main alternative theoretical underpinnings: transaction cost economics and management control theory. They propose that PBC can be seen as the interaction of three key areas: performance (specification and evaluation), risk (attitudes and transfer), and incentives (payment scheme and impact). The interplay between these categories will inform our analysis of PBC later in our study.

2.2 Triadic relationships in PBC

Triadic perspectives of supply network relationships offer a richer depiction of relational dynamics in PBC where interactions take place among three critical players (Wasserman and Faust, 1994; Obstfeld, 2005; Peng *et al.*, 2010, Vedel *et al.*, 2016). The principal-agent issue always takes place in

a triadic setting because the agent by definition resides between the principal on one hand and the suppliers or customers on the other. In a relational triad, an agent can create and exploit a structural hole, using the '*tertius gaunden*' i.e. the third party that profits strategy (Choi and Wu, 2009). The opposite of *gaunden* is called '*tertius iungen*' or the party that links, where the agent acts as a match-maker by linking two disconnected entities (Obstfeld, 2005). In the context of PBC, a general contractor will often consciously take the position of intermediary between the principal (government agencies) and other suppliers, or among multiple suppliers. Adopting an intermediary role gives the contractor informational advantage and opportunities to benefit themselves instead of the principal.

Industrial network research examines business structures where a number of nodes are related to each other by specific threads (Ford *et al.*, 2011: 182-183). The nodes are business units (e.g. producers, customers, suppliers) and the threads are relationships between the companies: both are laden with tangible and intangible resources (Håkansson and Ford, 2002). Industrial network thinking states that the network is: '*not a world of individual and isolated transaction [but]...the result of complex interactions within and between companies in relationships over time*'. Networks therefore can be deconstructed and analyzed as dyads or triads (e.g. Easton and Henriques, 1992; Havila *et al.*, 2004), where firm interdependency means the resultant impact of an interaction can '*hinder, weaken, strengthen or enforce*' a relationship (Ritter, 2000: 321). Triadic business relationships are very different and more complex to dyads where the customer has contact with both supplier and intermediary (Salo *et al.*, 2009; Vedel *et al.*, 2016). Such relationships also raise questions around the motivation of stakeholders seeking a more centralized position in the network ('network centrality') to gain business advantage over other agents through greater influence or power (Ibarra, 1993; Rowley, 1997).

The dynamics of triadic relationships represent an emerging and complex business issue, particularly today where the rise of service triads are fundamentally different in character to linear manufacturing (e.g. van der Valk and van Iwaarden, 2011; Gunawardane, 2012; Wynstra *et al.*, 2015). Service triads are where a buyer contracts with a supplier to deliver services (e.g. IT support, financial management) directly to the buyer's customer. Triads provide a critical context to better understand the nature and relative importance of various inputs for the service process, where the notion of an inherent supplier–customer exchange highlights the '*fluctuating role*' that a buyer may have (Wynstra *et al.*, 2015). In their recent proposals for a future research agenda, Wynstra *et al.*, (2015: 2) encourage not only further theoretical development on the nature of triadic interaction, but empirical studies which pursue the application of a more advanced repertoire of research methods on triads.

Choi and his colleagues have identified two practical scenarios of the agency issue where the decision to outsource and ensuing triadic relationship can lead to underperformance or failure. Rossetti and Choi (2005; 2008) found that in the aerospace industry, the OEMs, who are supposed to be the principals, actually become agents of the suppliers when the suppliers own the capital

equipment and tacit knowledge of manufacturing, resulting in supply chain dis-intermediation when the OEMs try to bully the suppliers. Li and Choi (2009) observe that in a service outsourcing triad, the supplier may take over the role as the agent during the post-outsourcing (i.e. contract fulfillment) phase of the relationship. The supplier assuming the role of agent may be detrimental to the service buyer depending on the relationship quality between the service buyer and his supply network.

The phenomenon described by Rossetti and Choi (2008) is a major concern in defence industrial procurement circles (Graham and Hardaker, 1998, Johnsen *et al.*, 2009; Caldwell and Howard, 2014). That is, the government procurement office is supposed to be the principal, and suppliers who are typically private companies, are the agents. In reality, the government procurement office can become the agent for the OEMs who in turn manages private supplier firms. The OEMs control who makes the product, supplies the technology, and are tasked with the overall job of coordinating the contract and negotiating with end users. The suppliers have clearly gained more leverage with the cutting back of government involvement in procurement and direct project management activities, yet there is little research which reflects these issues in terms of their specific evolution and performance over time.

What makes defence contracting unique from existing research on agency issues in relationship triads is twofold. First, the interests of the government buyer are presumed always to align with the end user (i.e. military forces). They are presumed to be the ‘government’ node in terms of how the triad is perceived. Yet, because of the protracted contract fulfillment process including design, building hardware and support services, the government buyer may not always have the same objectives due to changes in budget, personnel and politics. Equally important, when we look deeper into this node, the actual actors of the government and their influence change in different phases of the project. This raises the question of the efficacy of PBC in the context of complex programmes. Second, cutting back on government supply contract management and the emergence of private contractors playing the vacated government role of programme manager results in the dual role of private firms: as both supplier and agent, adding further complexity to the agency issue in the triad. What is not understood are the principal-agent dynamics over time in the context of PBC, and how such dynamics change supply network structure and network performance. In this sense, it is both a practical and theoretical question to investigate the principal-agent issues in defence contracts to understand the efficacy of PBC.

When any of the actors within the government node change, their objectives and motivation will change. This means their requirement of the supplier will be different at various stages of the contract. Similarly, when the supplier/OEM node tries to compete and attain a stronger position in the triad, they will change relational strategy over time given who the other government actors and suppliers are in the game. Therefore, the seemingly static triad contractual arrangement is not helpful in our analysis. Any strategic action from one node will affect the other, because they are

interdependent. Furthermore, one can also imagine that the strategic decision of any node will affect the suppliers the triad is connected with. While our focus is the triad, profound changes take place in the broader supply network based on what is happening over time with the nodes and the triad.

Understanding the nature of time-based, temporal aspects of triads is especially important in longitudinal investigations involving how network structures and relationships evolve. For example, Li and Choi (2009) observed bridge decay and bridge transfer in service outsourcing where, when a buyer severs a link with agent X and delegates the task of managing a project to agent Y, a new relationship is created, affecting the performance of the buyer. We surmise therefore that such bridge decay and bridge transfer will also play out in extended project-based contracting. The decay will result in a structural hole, which in turn will create tension and new connections in the network.

3. Methodology

The unit of analysis in this investigation is a UK capital construction project of a new warship. Defined here for anonymity purposes as the ‘new warship programme’¹ the study includes the period during which the vessel was conceived, designed, constructed and supported after launch, encompassing the 1970s through to 2014. Studies of contemporary defence contracting are relatively rare, possibly because of the need for high levels of security around military applications of new technology and their critical role in national defence. Yet the practical performance management and theoretical implications of contracting make such inquiry a significant and meaningful pursuit.

Our data includes 20 open-ended interviews with defence specialists and 5 site visits between 2005 and 2012 when our interest started in the warship programme. We studied archival data capturing the decisions and events leading up to its conception in the 1970s, 80s and 90s, and the contract execution up until 2014. Archival data includes written accounts from government white papers, academic papers, parliamentary reports, company annual reports, industry trade articles, books and newspaper articles relating to the programme that spanned a period of almost 40 years. One of the researchers was provided with access to restricted sites (e.g. dockyards) with staff invited to be interviewed on the basis of their level of involvement. The study was limited to the UK and included public procurement offices and naval installations, which provided an insider’s perspective of the players, the products and services specified in the contract and the dynamics amongst players. Interviewees included senior ranking royal navy personnel (e.g. Commander) with experience of warship command and administrative support, senior civil servants working in government procurement, and senior managers specializing in contract management employed by private defence contractors. The issue of how to overcome the problem of memory or time distortion concerning long

¹ The term ‘programme’ is used here over project because more than one product or unit (i.e. warship) of the same design was to be constructed according to the terms of the contract.

term supply relationships (i.e. distorted testimony) was addressed by first cross-referencing the accounts of several interviewees, and then comparing them with other sources of archival data.

We adopt a historical narrative method (Abbott, 2004). The narrative method in historical sociology is the established method used by historians and many social scientists to link temporally ordered events. Building theory with narrative using description and explanation of observed data means the researcher can draw conclusions over organizational processes (Pentland, 1999; Cunliffe *et al.*, 2004). The use of narrative provides not only explanatory power over how to reproduce organizational success or prevent failure, but stimulates critical reflection on the impact of time on practice (Klassen, 2007; Reddy, 2001). After a review of existing historical defence studies (e.g. Hartley, 1998; Hilditch, 1990; Croft, 2001) we analyzed primary and secondary documents (Abbott, 2004). Literature from public (i.e. government, MoD, navy) and private sector sources (industry, trade, technical, advisory) was analyzed to generate multiple perspectives for understanding agent behaviour and as an aid to triangulation (Voss *et al.*, 2002). Our findings are presented longitudinally (e.g. Berends *et al.*, 2011) with the narrative supported by graphic representations depicting the supply network relationship.

4. Findings

This section describes the network structures and PBC implications that correspond with the major development periods of the warship (e.g. initiation, formation, design, construction, operation).

4.1 Phase one: Programme initiation (1970-1988)

The new warship was one of the largest classes of ship ever to be considered for the Royal Navy. An initial decision was made by the ministerial Defence Committee to proceed with investigating the ship's feasibility, announced by the Ministry of Defence (MoD) in 1988. Public procurement structures at the time had remained relatively unchanged for several decades with individual departments for defence procurement and logistics (Hartley, 1998; Croft *et al.*, 2001).

The UK defence industrial landscape of the 1970s was characterized by a large number of medium-sized private manufacturing firms who worked on government contracts on a build-to-print basis. Additional costs incurred by the supplier as a result of having to deviate from the design *post agreement* would be borne by the public sector purse, leading to frequent and significant cost overruns. In British shipbuilding at the time, a steady drop in competitiveness with overseas shipyard firms eventually lead to a policy of mass nationalization in 1977. This was shortly followed by closure of over half of total UK capacity, with privatization of the remaining yards in the early 1980s. With the UK private maritime construction sector becoming increasingly squeezed by international competition, finding new ways to reduce the overall cost of construction had become a mantra in

government circles who sought to overhaul military contracting toward more defined performance outcomes: ‘...a significant move had to be made to make warships cheaper’ (RN Commander, 2009).

Figure 1 illustrates the triadic structure between the public and private sector around the time the new warship programme was conceived. It shows the relationship with the market governed by conventional defence procurement thinking and featuring high levels of control from central government in the form of the Defence Committee presided over by politicians, represented by a larger node. The political will to support the programme was crucial after the 1982 Falklands crisis in the South Atlantic which demonstrated the importance of maintaining a deep water fleet in the event of a territorial threat. Other organizations or ‘agents’ in the figure, represented by the smaller nodes, are connected by solid or dotted lines indicating the degree of interaction and flow of information (e.g. technical data, contractual agreements, materials, payment). The Defence Committee is strongly connected to the Treasury because of the requirement for public sector funding of new defence equipment. The connection with the market and defence industry suppliers is less established, shown as a dotted line, because of the shifting nature of the shipbuilding industry. Once approved by government, the task of coordinating the roles of the public and private sector in the formation of a project team for the new warship would be passed to the MoD.

As would be expected of a warship initiation phase, there was too little ‘hard’ information to contemplate outcome-based contracting. What should be noted though is that the prevalent contracting culture of the defence industry at the time was output-based contracts. These contracts typically transferred asset ownership from the private supplier to the public defence sector, and left through-life management of the asset as the responsibility of the new owner. These assets were relatively technologically unsophisticated, stand-alone items. However, radical rationalization and restructuring including the planned demise of many established defence suppliers suggested change was coming. Output-based contracting is associated with the customer having the competencies to measure and evaluate outputs (Ouchi, 1992). Notable also in this initial phase is that the customer or buyer still retained the volume and mix of buying staff to conduct output-based contracts.

Insert Figure 1 The UK defence industry (c.1980)

4.2 Phase two: Formation of the project team (1988-1990)

The decision by the politicians in conjunction with the Treasury in 1988 to approve plans for the MoD to commence an initial study into the new warship meant the formation of an internal project team comprising senior personnel and military advisors from the Defence Procurement Agency (DPA, now

Defence Equipment & Support). Public sector buyers started to approach the market to establish a shortlist of preferred suppliers based on criteria including past performance, capacity, design capability and price. Although many potential suppliers around the world were known to the public buyers, concerns around the issue of sovereignty or retaining strategic defence skills within Britain, meant the final decision had to satisfy the wider interests of the future of naval shipbuilding. As the largest naval contract of its type, the selection process involving the project team identifying suitable contractors to provide a state-of-the-art, fully functioning ship with provision of maintenance and repair capability was extremely challenging. It was decided that there was no one firm in the UK capable of building the proposed size of vessel alone. With the decision to proceed now made by the Defence Committee, responsibility for the forward momentum of the project was passed to the MoD.

The UK government in the late 1980s had become aware of the prevailing market conditions around shipbuilding and preferred to leave much of the day-to-day responsibility around supply chain coordination and market knowledge in the hands of the MoD. After the award of the construction contract, the shipbuilder typically became the general contractor who explicates the contracting relationship to tier 2 suppliers, who in turn provide specialist expertise in areas such as weapons and communication systems. The formation of an internal project team for the new warship meant the MoD could start to engage with potential suppliers. The role of MoD procurement, with its satellite public agencies such as logistics support, effectively created a new layer of administration in the formation phase of the programme. The public procurement organization was not only tasked with match-making private suppliers in line with outline specifications, but also implementing new working practices to cut defence costs as directed by government. *'The changes mean...the value of contracting is increasing [but] the number of contracts is decreasing'* (Senior Manager, DPA, 2006).

Insert Figure 2 MoD receives approval to create an internal project team

Figure 2 now presents the role of MoD procurement as the 'broker' or intermediary between government and the market during the early phase of the new warship programme. The MoD has become the customer of potential suppliers, building closer relationships in the private sector by approaching shipyards to understand their specific capabilities (e.g. steel fabrication, experience of assembling large vessels), with key information regularly reported back to government departments. This phase shows an established primary triadic relationship consisting of three public sector departments, and an emergent secondary triad between them and the market brokered by the MoD.

The decision to design the eventual contract to incorporate maintenance and repair would radically alter the boundaries between the public and private sectors. It also enlarged the scale of the contract in terms of the naval defence sector so that it became a 'must-win' contract: unless a supplier had a significant share of either the build or maintenance, then it had no future in UK naval defence. The must-win or 'only game in town' nature of the contract that emerges for this programme is particularly significant for the argument developed in our study over understanding the incentives associated with PBC in major projects.

In terms of developing PBC, what emerges from phase one and two is the mediated role of the customer. The Defence Committee is a customer, as is the MoD and its project team, and to some extent the Treasury is also a customer, therefore in contractual terms the customer role is somewhat ambiguous. This 'mediation' of the customer role is at odds with the clear definition of customer and supplier in most conventional sectors. Further, in terms of developing a capacity for PBC, the envisaged contract would require a new skill set from somewhat entrenched employees in both the public and private sectors, moving respectively from specifying and designing outputs, to designing outcomes and co-producing customer value.

4.3 Phase three: Design and proof of concept (1990-2002)

The following period between 1990 and 2002 was characterized by turbulent events in world history which effectively stalled many defence projects and had a profound effect on policy (Prins and Salisbury, 2008). For the new warship, it represented a time of internal debate and review by government and the MoD over the precise role any such vessel might have given the volatility of the world at the time. The fall of the Berlin Wall and subsequent collapse of the USSR meant much of the UK's conventional military policy was rendered obsolete. The future for more integrated armed forces was presented in the 1998 Strategic Defence Review (SDR) and followed by the 2002 SDR New Chapter, which responded to the security crisis after the 2001 September 11 terrorist attack. Cuts to conventional forces at the time raised questions over the need for a highly capital intensive new warship (Blackham and Prins, 2007). Intense pressure on government to reduce public spending in the face of a rapidly changing geopolitical landscape had a severe impact on many defence contractors. UK shipyards particularly were now struggling to survive the increasingly extended troughs of several decades or more between rounds of investment in new warships. This consolidation gave extra impetus for the larger corporations to explore and adopt new roles, leading to the emergence of a new type of organization: the systems integrator. The role these large corporations were to provide included coordination and programme management services from their increasingly diverse portfolio of skills and which augmented basic hull design and ship fabrication. More specialist contractors in weapons, navigation, ship safety and waste management could now work with the systems

integrators, often with little direct control from the MoD. *'Where the MoD starts and the industry supply chain finishes has been shifting for 30 years or more'* (Senior Manager DPA, 2006).

In 2002, the MoD eventually decided to go ahead with the warship programme, awarding the proof of concept phase of the contract to two principal defence suppliers who agreed to work together in a collaborative agreement. It was decided that the warship specification required an innovative design capable of being adapted to accommodate different types of equipment and weapon systems during its projected 60 year lifespan. Supplier 1 was a large British multinational defence, security and aerospace company, one of the new breed of systems integrator. Supplier 2 was a smaller multinational company of French origin that designed and built electrical systems and provided services for the aerospace, defence and security markets. Although originally competing against each other in their bid to win the contract, the two firms began working together: *'The more complex the commercial contract, the more depends on the relationship'* (Support Manager, 2011). Between them they produced a comprehensive computer aided design model which demonstrated the warship's feasibility to proceed to construction. Suppliers 1 and 2 were the only organizations in the UK with sufficient capacity and knowledge to handle the size of the new warship. Yet despite the collaborative agreement, Supplier 1 remained concerned over its long-term future and sought a competitive advantage by engaging in private talks with government. The discussions raised the possibility of a merger with Supplier 2: *'the consolidation of the...two surviving shipbuilders brings the industry full circle after nationalization in the 1970s'* (Webb, 2007). Already one of the largest defence organizations in the UK and growing systems integration and support capability, Supplier 1 began to realize the potential of a joint venture with the aim of a long-term agreement to secure its future in UK shipbuilding and running associated infrastructure such as naval dockyards.

Insert Figure 3 Decision to award conceptualization stage of project to two suppliers

Figure 3 depicts the decision to award the initial stage of the project to two suppliers. It shows the emergence of several new triads and reflects the significant increase in complexity and levels of interaction between agents involved in the programme. The primary triad concerns the MoD as broker between Supplier 1 and 2 who demonstrate a co-opetitive relationship (Dubois and Fredriksson, 2008; Pathak *et al.*, 2014) as they begin to work together. Information exchange is initially hesitant and restricted hence the connection is represented as a dotted line. While the MoD appears to occupy a position of power between the suppliers, the actions of Supplier 1 in participating in private talks over future contracts with government as represented by the thin dotted line, has the potential to undermine the working relationship with Supplier 2. That is, if the private talks between Supplier 1 and the

Defence Committee became public, Supplier 2 would feel marginalized and draw back from the collaborative agreement. The interaction between government and Supplier 1 seeking assurances over long-term business interests can be seen as potentially undermining the interests of Supplier 2. This private dialogue means the MoD's role as sole broker in the relationship is being gradually bypassed by an alternative line of communication, hence the structure is considered potentially unstable.

In terms of PBC, this phase adds the complexity of goal and scope change (goal uncertainty) to that created by the mediated role of the customer. Major defence procurements were a key context for the emergence of the systems integrator role. On the one hand, beyond the power dynamics above, the systems integrator (SI) adds a new level of expertise which enables PBC. SI's offer new capabilities at performance setting and evaluation for example, at the very time that the requirement for more complex and integrated technology and management structures reduce a customer/buyer's ability to specify input activities and processes. Furthermore, the continuing rationalization of the supply base, coupled with the need to support the indigenous industrial base, reduces the number of suppliers to be communicated with, whilst providing a driver for changing behaviour that act as enablers in buyer-supplier co-production and design: a core mechanism of PBC. On the other hand, SI's deepen the extent of customer mediation, performing a role that is literally being 'a customer for the customer'. In terms of the focus on defining outcomes and value for the customer as required in PBC, there is a lack of overall clarity.

This phase also suggests that, at least in this market sector, incentives are not always cash-based. Whilst Selviaridis and Wynstra (2015) acknowledge the influence of financial incentives, such incentives are discussed in terms of payments. Our description and ensuing triadic analysis suggests that the incentive that matters to defence suppliers is long-term market share. Such a perspective goes hand-in-hand with the emphasis on suppliers taking on more risk under PBC. One possible contribution is to identify the role future market share plays as a financial incentive, but not linked to payments *per se* in complex projects with extended timeframes such as defence platforms. This may be specific to the national public sector market, where the public sector as buyer can credibly negotiate over share in a market that it can control.

4.4 Phase four: Construction commences (2002-2008)

The MoD wanted commitment to shared responsibility by using joint performance incentives where any problem encountered during construction by one firm would be seen as a potential issue for all. Their idea was for strategic partners to come together during the construction phase as a '*UK team of all the available skills to de-risk the programme*' and not as individual organizations working independently (Defence analyst, 2008). In 2005, two more partners were added due to the technical nature of the contract: Supplier 3 was a British defence and services company which had diversified from ship building into engineering and support services. Supplier 4 was a provider of support

services for critical equipment and infrastructure in defence markets, specializing in the assembly of large marine vessels. Although Suppliers 3 and 4 brought specialist skills to the programme, all suppliers were to share responsibility for fabricating sections of the ship's hull and superstructure in yards owned by the firms across the UK. The modular design meant sections of the steel hull could be made independently and welded together afterwards, with the bridge superstructure added last. A new approach was taken with the signing of an alliance charter in 2005 outlining a code of conduct based on collaborative practices to be adopted by all five partners including the MoD in the warship programme. Using the charter effectively as their contract, the suppliers now worked with the MoD as equal risk sharing organizations. The alliance approach to managing performance meant that the five organizations assumed joint responsibility during construction. Ultimately it was the MoD's aim for firms to '*work exhaustively to achieve value for money*' (MoD Director, 2007). However, after the decision to fight two wars in Afghanistan and Iraq, mounting costs were top of the government's agenda and by 2008 '*the MoD had effectively become bankrupt [with] management of the defence budget deteriorating*' (Elliott, 2015: 224).

Insert Figure 4 Signing of the alliance charter means construction commences

There are two salient triad structures which emerge in Figure 4 and correspond with the start of ship construction. The MoD and Suppliers 1 and 2 have by now established their lines of communication and built up considerable experience of interacting with each other to a highly technical level. The second triad represents the addition of Suppliers 3 and 4 to the project who, although familiar with the workings of the MoD, have not worked together before and certainly not on a vessel of this scale hence the triad is shown with a dotted line. At this phase in the construction, having successfully negotiated the alliance charter, the MoD had re-established itself as the main broker in the programme with only occasional interaction from the Defence Committee in central government. Interaction at this stage was predominantly driven by parliamentary debate over the escalating costs of the warship, which had become widely circulated in the media at a time when world recession was affecting living standards in the UK. Using the alliance as the key contractual mechanism for controlling risk and performance, the role of the MoD was now to manage the dynamics between the four suppliers. Supplier 3 and 4 were smaller and newer, and ultimately less aware of the event history behind the programme.

In terms of PBC, this phase shows the emergence of a potential blueprint for how to manage the project and signifies a move toward contract management rather than contract design. We see several triads emerge as part of a new space for suppliers, against the backdrop of what appears a re-

invigorated MoD. Using the language of PBC, the MoD is attempting to create joint risk management through the formation of an alliance rather than risk transfer.

4.5 Phase five: Consolidation in the supply network (2008-2014)

Ongoing concerns in the government and MoD around escalating costs and maintaining the country's strategic naval shipbuilding capability were to return to affect the programme (Leftly, 2015; Elliott, 2015). Supplier 1 was on track to becoming a global player in the defence industry with a growing portfolio of orders in the UK, US and China. As a legacy of the 2005 Defence Industrial Strategy which highlighted the safeguarding of UK defence capability, the MoD encouraged Supplier 1 to begin discussions over a merger with Supplier 3. Continuing reduction in demand for British shipbuilding and complementary skill sets between the two firms meant a merger would likely be inevitable. In return, the MoD would sign a business agreement which placed the majority of future naval orders with the new company. The CEO of Supplier 3 explained his reasoning for the agreement as *'we don't want to get into a dogfight with [Supplier 1] over who would be the survivor'*. The two suppliers concluded their merger discussions in 2008, with Supplier 3 effectively being absorbed into a subsidiary of Supplier 1, conditional on agreeing to continue to work on the warship. The new joint venture was effectively the result of further consolidation in the defence maritime industry, where Supplier 1 emerged as bigger and more capable to take on large-scale construction and support work, both in terms of the current warship programme and on future contracts.

Figure 5 shows two triads forming around the remaining four organizations after the merger. The merged organization, now controlled by Supplier 1, is represented as a large node to show its new clout in the supplier alliance and strength when dealing with the MoD. Supplier 1's role was changing as the premier provider of surface warships and through-life operations support, becoming the government's strategic partner of choice for the total provision of future warships.

Insert Figure 5 Consolidation and merger in the alliance

In this phase, PBC is formally introduced by an innovative alliance structure intended to align all parties to solving problems and managing risk whilst creating the solutions the customer wants. The project picks up a new and political dimension in that cost overruns are now a matter of public record. The growing size of Supplier 1 dominates here, with its position as the UK's 'Number 1' in defence an officially sanctioned position and contributing to further supply base rationalisation by absorbing Supplier 3. Whether Supplier 1 was acting opportunistically or responding to global pressures, the outcome is the same: it is an immensely large, complex organisation that acts as SI and

mediates the relationships between customer(s) and the supply base. The sheer scale involved to compete for mega-projects such as defence platforms may create a barrier to PBC that is bigger than the gains achieved in interface simplification through supply base reduction.

4.6 Phase six: Operations and in-service support (2014 -)

The warship entered its final phase in 2014 with the first ship launched and sea trials started prior to commissioning into the navy. The original cost of the programme quoted a decade earlier had by now doubled. Furthermore, at least 3 years of delay had also been incurred due to the combination of structural changes in public procurement, including an attempt to privatize the military equipment acquisition agent and ongoing ministerial debate over changes to the warship's specification (Leftly, 2015). The accumulated delay through the programme meant the navy was now without an equivalent capital ship following the decommissioning of its predecessor in 2011. Yet the primary service support contract for the new warship had already been awarded to Supplier 1, now the most capable OEM with a portfolio of experience running naval shipyards and coordinating defence supply chains to provide support for all of the ship's systems. As part of its service agreement, Supplier 1 is obliged to liaise with navy personnel to trial all major technical areas of the warship needed to sustain the contracted number of available days at sea each year. While the alliance remains in place during the construction of the second warship, the position of Supplier 1 as not only naval dockyard owner but also primary repair, maintenance and technology upgrade provider means it has guaranteed business for several decades.

Insert Figure 6 Warship becomes operational (2014)

Figure 6 shows two triads with Supplier 1 as the sole broker (i.e. large node) firmly in a position of power at their intersection. The responsibilities of Supplier 1 as primary service provider means it can now effectively control the warship programme and could be seen as usurping the traditional role of the MoD as prime logistics coordinator. Supplier 1 mediates between the two remaining suppliers, MoD and naval personnel to whom it must hand over the ship in 2016 as fully operational and ready for deployment. Whilst the MoD maintains contact with suppliers through its membership in the alliance, the accumulation of skills and capabilities by Supplier 1 during recent merger activity and securing of the support contract means that it is at the pivot point of interaction. Given Supplier 1's vision to be '*...the premier global defence, aerospace and security company*' (S1 corporate publication, 2000), the strategy towards business growth adopted during the programme has been very successful, albeit limiting the choice of supply options for the MoD.

The last customer Supplier 1 must develop a working relationship with is the Navy, as indicated by the dotted line, who will eventually run the ship and its complex systems on military operations for sustained periods at sea. Naval personnel will rely on Supplier 1 for 24/7 technical support and warfare compatible specialist engineers who go to sea with the ship's company. Figure 6 depicts the final phase in the warship's evolution showing a marked reduction in the public procurement sector's sphere of influence, in line with its aims to reduce cost and the knock-on effects of industry consolidation. Supplier 1 has taken advantage of circumstances, assuming a role traditionally occupied by the MoD and is now contractually responsible for the continuous improvement of all aspects of the warship's performance lifecycle. The supplier is also in a prime position to incorporate lessons learnt into the second warship under construction.

In this final phase, Supplier 1 securing the maintenance and support contract acted to consolidate its new role in mediating virtually all supply relationships in the project. In PBC terms, they have become owner and manager of the risk. If they maintain the ship well, their overall costs will fall and profits rise. They own the processes for which they carry the risk and reward. Success in the role will reinforce the value of the incentive they valued most, guaranteed future market share which in turn drives the risk management element of PBC. To make this maintenance and support profitable and the risk acceptable, they need a high level of performance-related information (e.g. what to repair and when) that their SI role entitles them to. Supplier 1 is now in a strong position to reap the reinforcing benefits cycle of performance, risk and incentives that Selviaridis and Wynstra (2015) propose.

5. Discussion & Analysis

The historical narrative of the new warship programme illustrates the challenges experienced by the government and its defence ministry when seeking to engage with indigenous industry on a complex and long-term venture. The choice of a special form of mandated alliance as the incentive alignment mechanism to drive PBC was bold, but failed to take into account the way in which this arrangement either allowed or encouraged an ambitious supplier with global aspirations to dominate other stakeholders during construction. Despite increasing underperformance of the project through delays and cost overrun, the significance of the warship to the government in terms of security and employment meant Supplier 1 was able to renegotiate and strengthen its position. As the project moves from contract design to contract management, Supplier 1 appears to be in the driving seat, displacing the MoD as broker and now with a privileged position in dealing with the government over future contracts.

RQ1: *How do the patterns of interaction and principle-agent roles evolve over time in complex defence procurement?*

Adopting a longitudinal approach, our study engages with PBC not as a set of current practices to be explored, but as phenomenon that evolved over time when conditions that best suited PBC arose (e.g. performance-based, risk management). Our study in the defence industry begins with a clear, as in acknowledged and understood by both parties, boundary between the roles of the private sector and the public sector (see Figure 1). With regards to defence platforms, the private sector made them, sold them (i.e. transferred ownership) to the public sector, and who were then responsible for warship support and availability. In our study, the re-conceptualisation in phase two of the boundary between the public and private sectors is critical to the adoption process of PBC (Figure 2). Along with the transfer of responsibility for long-term support comes the need for contracting to go beyond the traditional output-based nature of defence contracts, and adopt a more collaborative stance between partners by forming an alliance, as depicted in Figure 4.

However, our case moves from a hierarchical industrial status quo where roles are known and fixed, to one where change becomes the norm and drives the adoption of new practices such as outsourcing and systems integration (Howard and Caldwell, 2011). There was significant rationalization of the supply base, significant cost competition from globalised production, and change in the basic industry *modus operandi* in the form of a changed military threat during phase three (i.e. 911 terrorist attack). Yet the most important change in terms of enabling the adoption of PBC was the change in boundary between industry and the public defence sector, which could only work in a rationalised industry now aware of the need to modernise and co-operate to survive. Our study suggests that supply base rationalisation is a necessary precursor to make PBC and the participative relationships it demands operate effectively.

In terms of principle-agent roles, our findings show the withdrawal of the government from a position of authority and the specific strategy of one supplier to occupy the vacated role as systems integrator (see Figures 5 and 6). Over time the relationship between principle and agent changes where, as Supplier 1 gradually increases its position of power and control over the project, it effectively holds the customer hostage. This evolution in triadic network structure over time has major implications for complex defence procurement and PBC, explained further below.

RQ2: *What does agency theory and triadic dynamics contribute to our understanding of the conditions necessary for PBC?*

Agency theory helps us to understand the conditions necessary for PBC by allowing changes in position and role in supply network structure to be examined over time and from the perspective of multiple stakeholders. Our study includes evidence from public sector participants in phase one that makes clear their view that defence sector structures such as the traditional boundary between the

private and the military sector must change. Perhaps it is an inevitable by-product of creating change, but the effective (although not necessarily intended) retreat of the public sector MoD from attempting to control the defence market creates a fluidity in principal-agent roles (Obstfeld, 2005; Choi and Wu, 2009; Wu *et al.*, 2010) leading to the rise and dominance of Supplier 1 during the project.

Our study treats defence as a sector where triadic relationships dominate, even when triadic relationships are nested within other triadic relationships (e.g. Defence committee, MoD, Suppliers, and nested within that: Supplier 1, MoD and the Navy). Where the longitudinal approach combined with a triadic perspective adds most value, however, is in being able to trace how the principal and agent's roles are not static over time as such theory is commonly portrayed (Eisenhardt, 1989; Hill and Jones, 1992). Table 1 illustrates the evolving roles in the new warship programme where in none of the phases one to six does the combination of principal-agent remain the same. In the case of the public sector we see a retreat, conscious or accidental, from the principal role. What stands out is the sustained drive over time to achieve the principal role from Supplier 1. As we step back and assess the six phases of triadic structure together, we begin to see a pattern of business strategies emerging from the actions of Supplier 1 whose behaviour is noteworthy not just in the ability to acquire industrial capacity through merger activity, but also because of its constant maneuverings within the network primarily to secure work for the future. In terms of the conditions necessary for PBC, the covert control-seeking behaviour of Supplier 1 conducted throughout the project conflicted with the collaborative alliance approach agreed by the five partners when warship construction commenced. Unlike traditional PBC conditions where roles are assumed to remain the same, we surmise here that during extended contract fulfillment periods, members of the triad may adapt by taking different roles over time or change completely at difference phases of the contract.

Insert Table 1 Evolving roles of principal-agent during the new warship programme

Using triadic theory to understand the case, Supplier 1 always tries to increase its role as a broker in the triads by applying a *tertius gauden* (i.e. the third party that profits) and *tertius iungen* (the party that links) strategy sequentially. Supplier 1 takes a 'two step' approach to stay ahead of competing supplier firms: 1) It creates a structural hole between the suppliers and the principal, and then offers itself as an intermediary; 2) Supplier 1 then 'fills' and therefore removes the first structural hole in order to create synergy and execute the contract when it then creates a new, second structural hole between its captive supplier and new principal. Hence, we see an alternation of 'gauden-iungen' as Supplier 1's network strategy. The dual strategy of sequential gauden-iungen is interdependent. Linking takes place only when the focal player secures a new critical external link, because this gives it leverage in the form of a new structural hole. The external link creation also corresponds with the addition of new skills to Supplier 1's portfolio, which are relevant to future programmes. This process

explains the trajectory of Supplier 1 becoming a full-service contractor, while at the same time retaining control of production infrastructure involving other suppliers in the network.

RQ3: *Why did PBC underperform in this type of extended government contract?*

Addressing RQ1 and 2 above identified how fluid and affected by external changes the role of the customer was in this study, resulting in a ‘mediated customer’. Studying complex defence procurement over a thirty year period suggests that the role of the customer, and indeed the requirements (or value) sought by the buyer, are ambiguous in a way that the PBC management literature does not acknowledge. Specifically, the unstable and inconsistent nature of the public buyer/customer is not consistent with the clear delineation of buyer and supplier roles in literature. Our study suggests that this lack of role clarity and consistency over time is a major cause for the underperformance of PBC in this type of contract.

As a sector, defence has been seen traditionally as a unique setting that lacks the marketing imperative of most business areas (Hislop, 2000). In addition, the sheer scale, scope and timeframes of major projects challenge management thinking about PBC. For example, studies of PBC in logistics service provision do not have to grapple with the entrenchment of attitudes, ways of working and assumptions about the other party, that builds up over time to such a degree due to the long-term focus of the sector. In spite of a seemingly ‘perfect storm’ of reasons for radical change, it is still not proven that the employees on all sides of the warship programme responsible for making the new ways of working effective did actually embrace the alliance as an opportunity. Again, studying PBC longitudinally raises an issue that is not common in the PBC literature: how far does the workforce responsible for its execution (public and private) genuinely adopt new working practices? And, to what extent are older, more output-based behaviours continued? One possible cause for the lack of success in PBC in this case may be the conservative behaviours of the entrenched workforces, public and private. Employees could see all around their headcount being reduced and rationalised, and whether these observations catalyzed or limited more radical behavior needs to be further assessed.

In terms of the scale and long-term orientation of major platforms contracting, this case is one of the largest and longest recorded implementations in the defence sector, with major implications on the nature of two key elements of PBC: the transfer of risk and the nature of incentives. Although the contract in terms of hardware is eventually delivered, we see significant underperformance in terms of delay and budget overrun. What we also see is genuine risk-taking by Supplier 1, but only when risk is offset by a potentially bigger opportunity in the form of control of long-term warship support. In addition, and as other authors have noted (e.g. Roehrich *et al.*, 2014), it is extremely difficult for public sector buyers to fully transfer risk. Additionally, if suppliers want market share above all other incentives, then joint incentives (Hypko *et al.*, 2010; Kleemann and Essig, 2013) will in the long-term negate the partner interdependence deemed key to the delivery of contracted performance outcomes.

PBC underperformed in this contract not just because of government indecision over specifications, but because the contractor was allowed to engage in control-seeking behavior over long periods of time, exploiting structural gaps left by public agencies and eventually holding the government hostage over the warship's future. Ultimately this meant Supplier 1's commitment to the alliance was put second in favour of the self-interest of the firm.

5.1 Implications for PBC

Firstly, current thinking is that PBC is designed to share risk and incentives between contracting parties (Selviaridis and Wynstra, 2015). The assumption is that the principal and agent are independent parties and that the principal (e.g. the government) has a general understanding of the required contract performance when the contract is complete (Kim *et al.*, 2007; Sols *et al.* 2007; Ng *et al.*, 2009). In our study however, the eventual supply arrangement significantly reduced interdependence between principal and agent. The government becomes more dependent on Supplier 1. As a result of industry consolidation and loss of technical skill by the government, Supplier 1 has increasingly taken on a government role with a strong influence on future spending.

Second, we find from our study that PBC requires a clear delineation of roles, and will underperform or fail when roles keep changing. When the principals in the supply network change (i.e. Defence Committee, MoD, Navy), the agents have multiple masters. The agents, in this case the suppliers, have different masters over time. This provides the supplier with the opportunity to leverage its experience over extended periods of the project, giving it an information advantage and technical expertise to create structural holes and dependency (Zaheer and Bell, 2005). Such analysis runs counter to PBC literature on risk allocation (Brady and Davies, 2011), where it is assumed that roles in supply networks do not change and are clearly communicated over who is the buyer, supplier or principal.

Finally, PBC was conceived in an environment of over-riding government control. Yet the programme was implemented against the backdrop of change at multiple levels, including industry (e.g. consolidation, extended peacetime punctuated by debate on weaponry and future warfare), and national economy (privatization, servitization of manufacturing, budget cuts). Thus, a 30 year cycle in shipbuilding from nationalization to privatization came full circle where the responsibilities of Supplier 1 resemble that of a quasi-government agency in providing total service support, running repair yards and taking ownership of defence infrastructure. PBC therefore needs to go beyond current applications in the private sector as a dyadic mechanism, and consider the implications of more complex situations involving triads, particularly as examined here as public-private triads. In cases of extended public procurement, models based on performance, risk and incentives (Selviaridis and Wynstra, 2015) need to be augmented by factors relating to public-private boundaries and the implications of extended contractual timeframes.

6 Conclusion

This study has major implications for performance-based contracting in similar largescale procurements. We explain the efficacy, or lack thereof, of PBC in public procurement. The insights provided by the warship programme demonstrate the challenges facing government-contractor alliances seeking to adopt PBC in western defence markets which comprise fewer, but strategically more adept players (Geary and Fowler, 2014; Caldwell and Howard, 2014; Jones and Hollinger, 2016). The nature of such programmes: their long duration, changing principals, the interaction of competing supplier strategies, political uncertainty and technological expectations, all make it difficult for the investigator to evaluate individual firm behaviour in the context of overall performance.

Our paper offers some challenges to the theoretical answers provided by buyer-supplier relationship informed agency theory, particularly the issues around contracts that span multiple decades and involve multiple triadic public-private arrangements. Although PBC appears to include mechanisms to transfer risk to suppliers, complex procurements such as our study suggest suppliers or contractors (who, as in our study, can become dominant actors) are not necessarily the inert recipients of risk transfer. Our study suggests that PBC needs to take a more nuanced and iterative approach to risk transfer. We cannot argue that risk transfer does not happen under PBC, but our study does suggest that a procurement of any complexity, to maintain such transfer of risk over time, potentially involves serial adaptations in the form of responses to the iterations of opportunist supplier behaviour (Tate *et al.*, 2010; Brown *et al.*, 2000; Lambert and Cooper, 2000).

There is also a theoretical contribution to be made using our case over performance-based government defence contracts and investigating the dynamics behind consolidation, interdependence vs. explicit strategies of firms, and supply network relationships (Ritter, 2000). Through the lens of the relationship triad and by assessing the evolution of the principal-agent role, we identify a strategy of sequential *gauden* and *iungen* over time (Obstfeld, 2005; Choi and Wu, 2009; Wu *et al.*, 2010). We find that firms alternate both approaches when we look beyond the triad and across a wide span of time. The sequential *gauden* and *iungen* approach offers not only a more accurate depiction of firm's strategy in supply networks, but also a unified view of two competing actions. Hence, using the triadic framework, we are able to understand the concept of individual role evolution by principals and agents in complex, long-term public-private relationships.

The practical implications for managing government procurement contracts are raised here in terms of relevance to other industries. Government cost-cutting underpins the current trend for outsourcing contracts, which in turn means government agencies have to rely more on private suppliers to drive PBC and outcome-based solutions. Such thinking shifts supply network management and PBC responsibilities squarely into the contractors' domain, to the extent that

contractors or systems integrators must begin to consider wider market management issues such as the long-term profile of critical skills and national production capacity, in addition to more traditional delivery and support issues. Our case of government procurement highlights how retaining industry skills informs complex public-private scenarios and hints at future capability to deliver complex solutions effectively. Finally, as these roles change, what mechanisms will align private sector contractors in future with issues such as market management for long-term job prospects and the minimum industrial mass necessary to preserve critical areas such as national defence?

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Table 1 Evolving roles of principal-agent during the new warship programme

	Role	
	<i>Principal</i>	<i>Agent</i>
Role evolution	<i>Phase 1</i>	
	Defence committee	•
	Treasury	•
	Suppliers	•
	<i>Phase 2</i>	
	Defence committee	•
	Treasury	•
	MoD	•
	Suppliers	•
	<i>Phase 3</i>	
	Defence committee	•
	MoD	•
	Supplier 1	•
	Supplier 2	•
	<i>Phase 4</i>	
	MoD	•
	Supplier 1	•
	Supplier 2	•
	Supplier 3	•
	Supplier 4	•
	<i>Phase 5</i>	
	MoD	•
	Supplier 1	•
	Supplier 2	•
	Supplier 4	•
	<i>Phase 6</i>	
	MoD	•
	Supplier 1	•
	Supplier 2	•
	Supplier 4	•
	Royal Navy	•

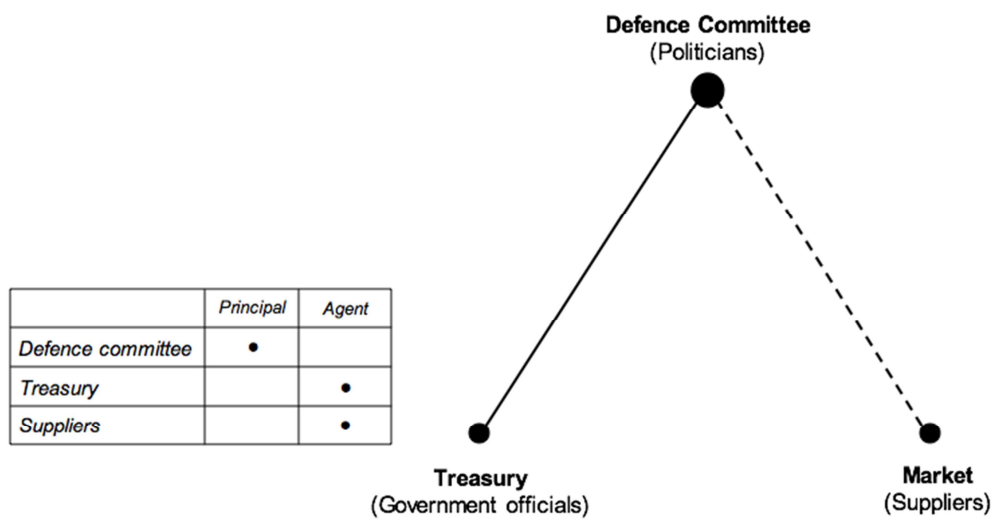


Figure 1 The UK defence industry (c.1980)

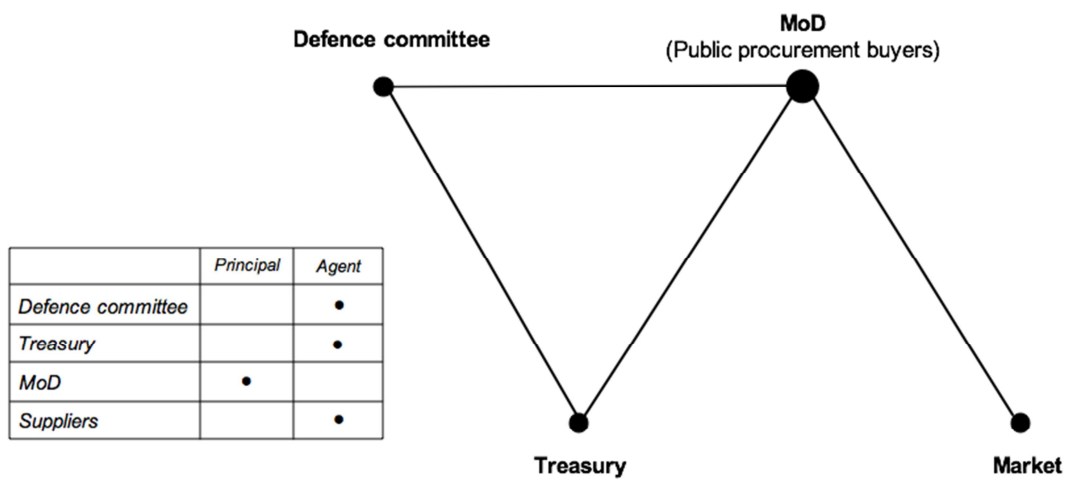


Figure 2 MoD receives approval to create an internal project team

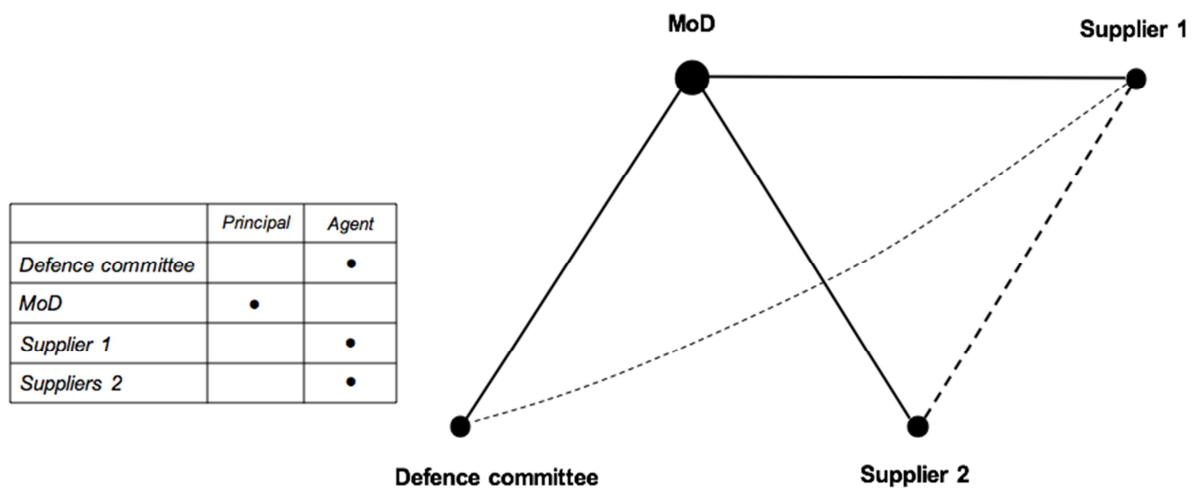


Figure 3 Decision to award conceptualization stage of project to two suppliers

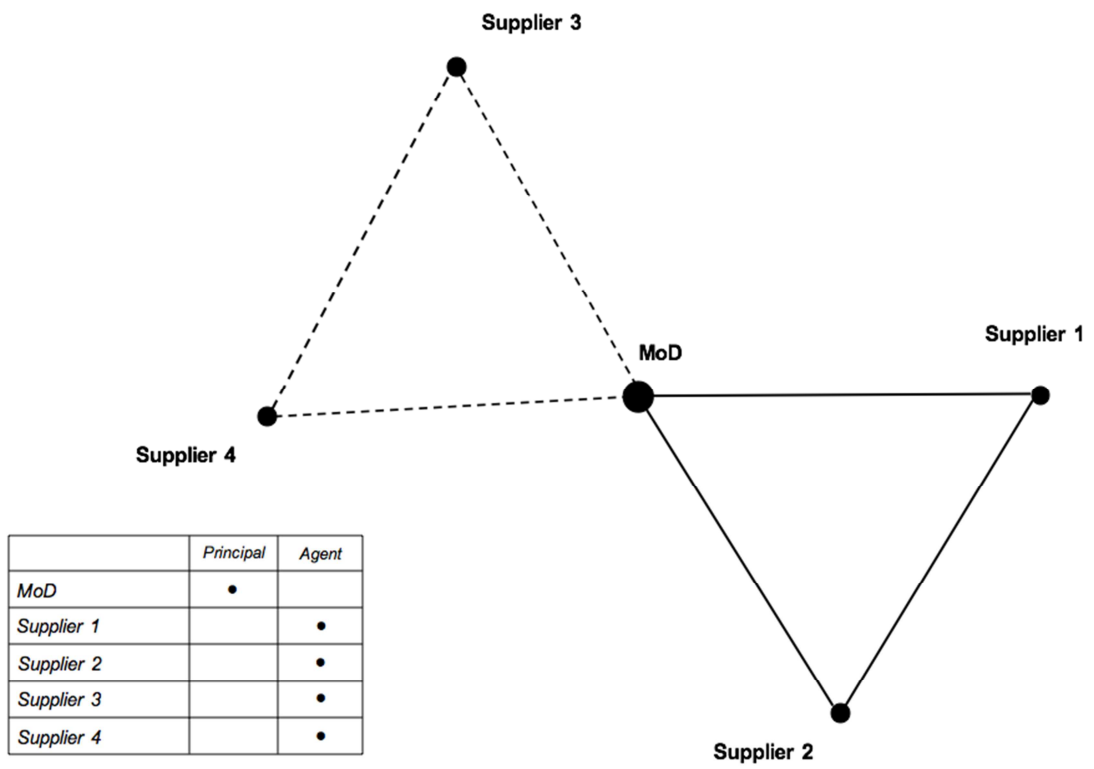


Figure 4 Signing of the alliance charter means construction commences

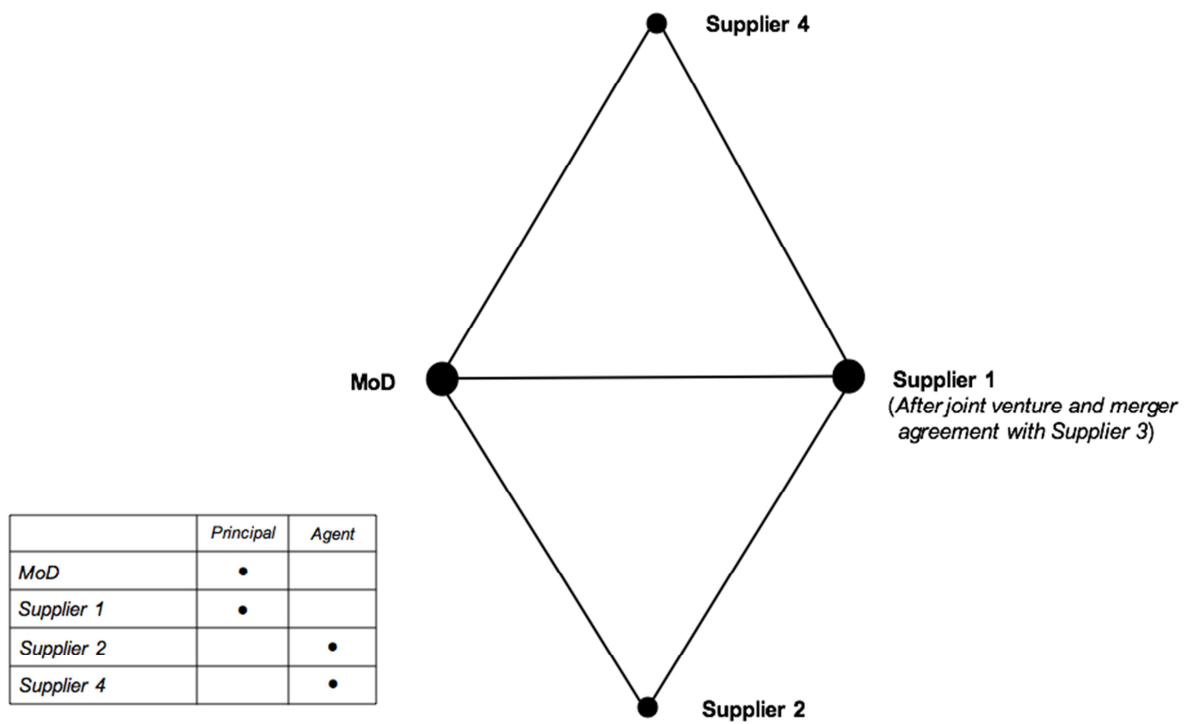


Figure 5 Consolidation and merger in the alliance

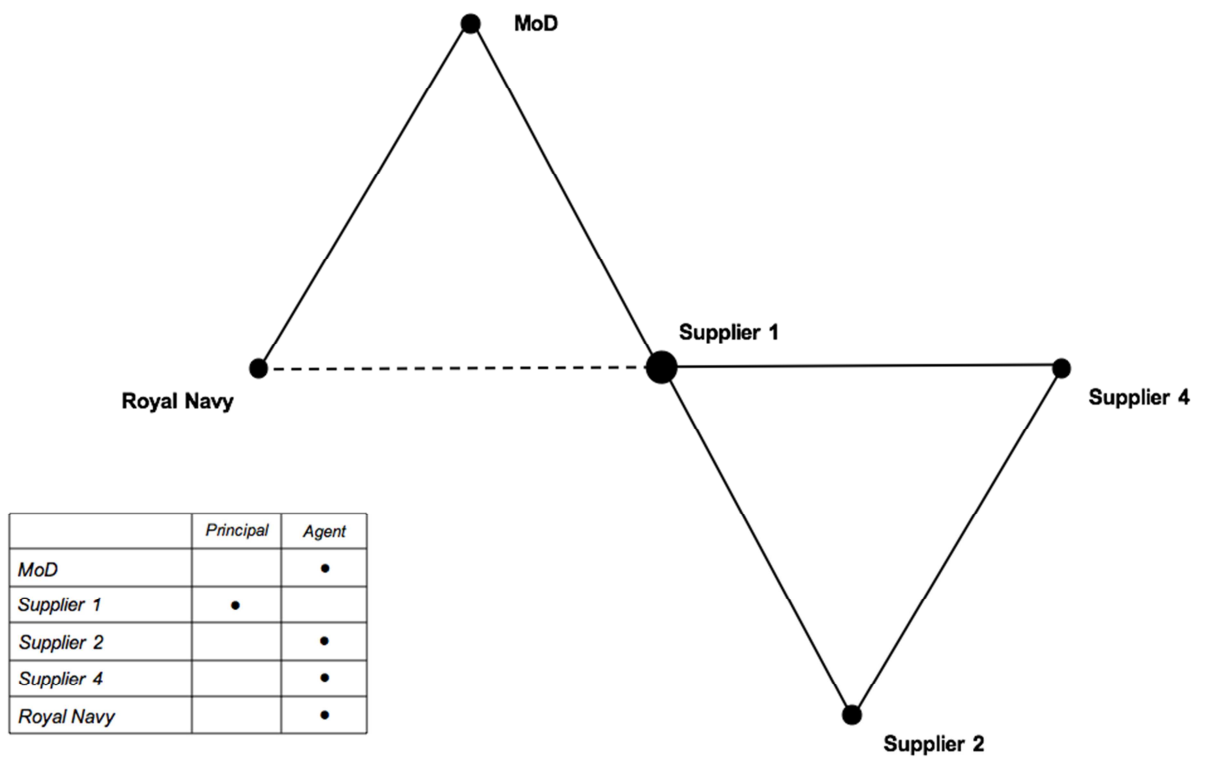


Figure 6 Warship becomes operational (2014)