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The manifestation of coordination failures in service triads

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Abstract

Purpose – The paper investigates governance in service triads, specifically studying significant steering and connecting coordination failures in order to reveal typically hidden characteristics and consequences.

Design/methodology/approach – This study focuses on coordination functions and activities between a buyer (a government department), a customer (a military service) and two service providers. Rich data on these normally confidential service ties are drawn from an official report into the causes of a fatal accident involving a UK reconnaissance aircraft and specifically from the evidence presented regarding the earlier development of its complex safety case. We also analysed a range of additional secondary data sources.

Findings – We examine the sources, drivers, and manifestation of coordination failures. We uncover a series of coordination failures driven from the bridge position, revealing that while bounded rationality and opportunism influenced steering coordination failures, connecting coordination failures were associated with knowledge asymmetry, dyadic inertia, and unethical practices.

Practical implications – Organisations and governments delivering complex projects and KIP services should guard against outsourcing the 'coordination' activity to a third party, and thereby relinquishing the bridge position. Handing over the bridge position to an integrator would leave the client vulnerable to coordination dysfunctions such as bounded rationality, opportunism, knowledge asymmetry, dyadic inertia, and unethical practices.

Originality/value – The study links the previously separate research streams of service triads and coordination functions and activities. While extant research pays attention to mainly positive control functions, this study focuses on all three actors in two (failed) service triads—and highlights the impact of coordination activities and coordination failures.

Keywords: Service triads, inter-organisational relationships, coordination, coordination failures; professional services; service operations; secondary data analysis

Paper type - Research paper

1. Introduction

Service supply chains are structurally, as well as managerially, distinct from physical supply chains (Giannakis, 2011; Sampson and Spring, 2012). In contrast to goods-focused supply chains, service supply chains are bi-directional in nature, as customers provide inputs into the production process (Sampson and Spring, 2012). In other words, service-providers cannot operate service processes until the customer inputs have been received (Lovelock, 1983; Sampson and Froehle, 2006). Thus, the performance of the service is contingent on governance and effective coordination of inputs from multiple actors in the bidirectional supply chain (Selviaridis and Norrman, 2014).

Governance issues become even more complicated with the introduction of additional actors as the complexity of the inter-organisational relationship evolves from a dyadic to a triadic- or network level. Service triads typically consist of three actors involved in a service exchange. Unlike service supply chains, there are interdependencies between the three actors, which makes the attribution of risks, responsibilities, and performance difficult. A normative triad consists of a service provider, service buyer, and the service customer (Li and Choi, 2009). Another type of triad is the 'buyer-supplier-supplier' triad, where multiple suppliers are providing services to the buyer (Choi and Wu, 2009a; Wynstra et al., 2015).

Prior governance studies investigating the management of inter-organisational relationships have begun to focus on how relationships are controlled and coordinated through formal (such as contracts) and informal (such as trust) governance mechanisms (Roehrich, Tyler, et al., 2020; Schepker et al., 2014; Zheng et al., 2008). Some scholars have also started to examine these specific challenges in service triads (van Iwaarden and van der Valk, 2013). While the concept of triadic control has received some more attention (for example, Li and Choi, 2009; van der Valk and van Iwaarden, 2011), prior studies offer limited insights regarding the concept of coordination (a notable exemption is Bastl et al., 2019), despite its

importance for driving performance (Oliveira and Lumineau, 2017). Consequently, our study focuses on coordination in service triads. Specifically, we investigate how such coordination fails. Following Gulati et al. (2012), we define inter-organisational coordination failures as the problems hindering the combination and integration of the organisation's resources in a joint effort. While some scholars have examined a range of coordination failures such as a mismanaged crisis response (Moynihan, 2009), and profit decline due to newly implemented policy changes (Aggarwal et al., 2011), prior work offers very limited insights concerning the drivers and manifestation of coordination failures in service triads. Without examining the coordination failure in service triads, our understanding of governance in service triads will remain incomplete. Thus, this study addresses the following research question: *How do coordination failures manifest in service triads?*

We address this research question by investigating two service triads, consisting of a buyer (part of a government department), a customer (a military service) and two professional service providers. We follow the call by Bastl et al. (2019) to focus on all three actors in a service triad to better understand coordination, thus offering a more detailed investigation of the triad by not only focusing on a single actor (e.g., Li and Choi, 2009) or a single dyad (e.g., Karatzas et al., 2016) within a triad. The research draws on rich secondary data including an official report into the causes of the in-service loss of a UK aircraft and its crew, and in particular, on the evidence presented regarding the development of a complex safety case for this type of aircraft. The particulars of this 'story' offered a revelatory case study (Yin, 2018) of coordination failures in two service triads and highlighted some of the principal coordination challenges associated with buying complex services.

This study develops two distinct, yet inter-related, contributions. First, extant studies on the governance of service triads have paid more attention to how the focal firm can control the interactions and activities within the triad (Li and Choi, 2009; van der Valk and van

Iwaarden, 2011). More recent studies have begun to examine both control and coordination in governing service triads (e.g. Bastl et al., 2019). We extend the work by Bastl et al. (2019) by focusing on coordination in service triads and examining steering and connecting coordination functions (Oliveira and Lumineau, 2017). Moreover, while Oliveira and Lumineau (2017) unpacked the coordination of inter-organisational networks by identifying steering and connecting function, and the activities associated with them, we extend their work by examining the failure of steering and connecting coordination functions across two service triads. Our findings support recent literature arguing that all three parties bear responsibility for coordinating a service triad (Bastl et al., 2019) while further suggesting that the party at the bridge position is a key source of coordination failures. Second, in contrast to prior studies which mainly focused on successful and high-performing service triads, we investigate coordination failures and their impact on service triads. We identify the causes of coordination failures and link them to steering and connecting coordination functions. By doing this, we provide an extension to our understanding of coordinating service triads. For example, Oliveira and Lumineau (2017) argue that a fit between the prevalence of steering or connecting coordination functions is essential for network performance. We extend this stream of literature by positing that buyer's bounded rationality and service-provider's opportunistic behaviour may lead to steering failure in service triads. Moreover, connecting failure in service triads is caused by knowledge asymmetry between the actors, dyadic inertia in the triad, and unethical practices.

The remainder of the paper is structured as follows: the next section introduces the core notions of service triads, with a particular emphasis on coordination failures. Section 3 discusses the methodological considerations and a description of the case context and findings are presented in section 4 and 5. Section 6 discusses the findings in light of the conceptual

background and conclude by formulating theoretical and practical implications as well as outlining future research avenues.

2. Literature review

2.1 Service triads

While inter-organisational relationships are predominantly analysed using a dyadic lens (Holma, 2012; Howard et al., 2019), most service exchange situations involve three (or more) actors. Therefore, the notion of triadic interaction offers scholars a mechanism to frame some key 'beyond the dyad' challenges. For instance, a buyer may have to choose between two competing suppliers (for example, Choi and Wu, 2009b, 2009c; Dubois and Fredriksson, 2008; Li et al., 2010; Wu and Choi, 2005) or a supplier may face two potential customers (Choi and Kim, 2008). Such instances are relatively more common in manufacturing contexts. Service triads, in contrast, typically involve interactions and relationships between three entities which are a buyer, supplier, and customer (Vedel et al., 2016; Wynstra et al., 2015). In this case, a service buyer contracts with a service provider to deliver services to a customer. The defining attribute of a service triad is that customer satisfaction depends upon the relationship between the customer and service buyer's supplier (Bastl et al., 2019; Karatzas et al., 2016, 2017).

Some service triads are responsible for delivering various knowledge-intensive professional (KIP) services. KIP services have long been procured in a very traditional fashion as instrumental services (Wynstra et al., 2006) but a large number of these arrangements involve direct and frequent interactions with the buyer's customers (e.g. requirements capture and (contract) negotiations, analysis, innovation forums, prototype testing (cf: Spring and Araujo, 2009)). Given that such arrangements can extend over multiple years and/or projects, the service supplier effectively becomes 'tied' to the buyer's customers. At the same time, KIP service triads that are being set up as complex services are often outsourced in order to

minimise expenditure, leverage economies of scale and scope (Davies et al., 2007) as well as potentially accessing new innovations and capabilities (Antonelli, 1998). KIP services represent a particularly vital area for further conceptual development. From the complex and contingent nature of the service processes (Lewis and Brown, 2012) to the idiosyncratic managerial control challenges (Harvey, 1990; Goodale et al., 2008) - research in this area has the potential to develop novel insights, understanding and theory enhancement (Harvey et al., 2016).

The interaction between the three actors in the (KIP) service triad could be constant or intermittent (Wynstra et al., 2015). Early literature on service triads has focused on exploring the structural dynamics. For example, Li and Choi (2009), adopting a social network perspective, posited that in the presence of a structural hole between two actors, the third actor bridging these two actors would receive information and control benefits (Burt, 1992). The role of bridging would usually be the domain of service buyer. Once the bridging occurs, and the two previously separated actors start connecting with each other, the state of 'bridge decay' is created. Furthermore, the service buyer may, willingly or unwillingly, relinquish its bridge position to the service provider, thus creating the state of 'bridge transfer'. The buyer would then lose the information benefits that were afforded to him in the bridge position. In sum, the structure of triad has important implications for governance of intra-triad relationships, leading actors to maintain or relinquish their positions (Li and Choi, 2009).

In addition to exploring the structural dynamics of service triads, prior studies have also explored how the interactions and relationships between the actors are managed. For example, due to inherent task interdependencies between the actors, cooperation between the three actors becomes critical for improving service quality and alignment of interests and capabilities (Finne and Holmström, 2013). Similarly, Andersson-Cederholm and Gyimóthy (2010) emphasised the dialectic tensions inherent in a service triad (i.e. loyalty and disloyalty, trust

and distrust), while Van der Valk and Van Iwaarden (2011) concluded that service triads could be properly governed by the right combination of (legal and social) contracts and monitoring activities. Other studies have explored the issues around actors' roles and interpersonal interactions in service triads (Holma, 2012).

More recent research has focused on control and coordination in service triads (Bastl et al., 2019; van Iwaarden and van der Valk, 2013). One of the key findings of this research stream has been to explore the roles of participating organisations in controlling and coordinating service triads. While some studies emphasised the role of the central actor (the bridge) or a key relationship in controlling service triads (Karatzas et al., 2016; Li and Choi, 2009; van der Valk and van Iwaarden, 2011), other studies have argued that all three actors are responsible for controlling and coordinating the triad (Bastl et al., 2019). Extant research on service triads has mainly focused on examining control in service triads (van Iwaarden and van der Valk, 2013; Li and Choi, 2009). In contrast, the concept of coordination in service triads remains under-developed (Bastl et al., 2019); thus, by focusing on coordination in service triads, our study addresses the gap in this emerging stream of literature.

2.2 Coordination failures in service triads

In a service triad, the satisfaction of the customer with services depends on the interactions and relationship between the customer and the buyer's supplier. Therefore, the buyer needs to coordinate the activities and interactions within the service triad. Coordination is defined as the alignment and integration of activities, processes, and roles to accomplish jointly determined goals (Gulati et al., 2012; Van de Ven et al., 1976). Understanding the drivers and barriers to coordination is critical because failures in coordination result in inefficiencies and delays, as well as eventual relationship breakdowns (Gulati et al., 2012). Moreover, task dependencies in

complex organisational arrangements such as service triads further emphasise the importance of coordination between the actors and their activities (Caldwell et al., 2017).

In the past, mainly general and strategic management studies have conceptually and empirically explored the concept of coordination (e.g. Bechky, 2006; Gulati et al., 2012; Ranganathan et al., 2018; Van de Ven and Walker, 1984). Recently, the concept of coordination has been further dissected by uncovering functions - in particular steering and connecting - and their related activities which drive coordination (Oliveira and Lumineau, 2017). The steering function includes activities such as: (i) goal setting; (ii) enforcing; and (iii) constraining-action. The goal-setting activities refer to the specification of requirements such as time, cost, and quality. Enforcing activities are formal and informal actions undertaken by the focal firm in ensuring the service conforms to the specifications. Finally, the constraining-action activities refer to the mechanisms put in place to restrict the partner to deviate from standard operating procedures without submitting sufficient documentation and receiving approval. These activities are implemented through more structural mechanisms such as formally written contracts, hierarchical controls, and modularisation (Gulati et al., 2012; Oliveira and Lumineau, 2017; Tee et al., 2019)

In contrast, the connecting function of coordination includes activities such as: (i) monitoring; (ii) engaging; and (iii) liaising. The monitoring activities refer to actions taken by the focal firm to ensure the process and the output would meet its requirements. Such actions include regular checks regarding quality and work progress. Engaging activities include bringing organisations together to address any problems faced by the partners, joint problem solving, and arriving at a mutually agreed solution. Liaising activities refer to the actions taken by the focal firm to connect partners to other organisations and reconcile any divergences. Examples include getting approvals and licenses from local councils and working with organisations to identify and implement sustainability guidelines. These activities are

implemented through more relational mechanisms such as boundary-spanners, network orchestrators, and integrators (Gulati et al., 2012; Oliveira and Lumineau, 2017; Paquin and Howard-Grenville, 2013; Tee et al., 2019).

Although management scholars have traditionally emphasised the beneficial effects of closer relationships between partners, there is a recent shift in the literature towards exploring the dark side of inter-organisational relationships (Heirati et al., 2016; Moretti and Zirpoli, 2016). For example, Villena et al. (2011) have identified an inverted curvilinear relationship between social capital and performance. Recently, Oliveira and Lumineau (2019) have also provided a useful overview of the antecedents, consequences, moderators, and manifestations of the dark side of inter-organisational relationships (such as conflicts, opportunism, and unethical practices). Our study continues this tradition by investigating a yet under-explored area of research. While it has been established that coordination failures lead to low performance, there is very little understanding of how these failures manifest in inter-organisational relationships, and service triads in particular. Thus, this study explores coordination failures in service triads by investigating functions, namely steering and connecting, as well as associated activities.

3. Research Method

3.1 Research approach and sampling

The objective of our research was to understand the manifestation of steering and connecting functions leading to coordination failures in service triads. Consistent with our objective of identifying explanation of a complex phenomenon in its natural context (Eisenhardt and Graebner, 2007; Ketokivi and Choi, 2014), we adopted an in-depth case study approach. To fulfil this objective and address our research question, we had to sample on four criteria. First, we had to select a persuasive example of failure in service triads, along the lines of Siggelkow's

(2007: p20) "*talking pig*" (Lewis and Brown, 2012; MacCarthy et al., 2013). Second, we needed a context exhibiting both contracted and non-contracted relationships, which would enable us to examine the variance (or lack thereof) of steering and connecting functions, thus leading to coordination failures. Third, the actors should be independent entities to demonstrate clear structural linkages and the overall task needed to be complex and composed of interdependent activities to require coordination across them. Fourth, we were interested in a context where 'pure' services (Chase, 1978) are being exchanged in the triads. Knowledge intensive professional services raise some interesting challenges for coordination as they are inherently characterised by variable judgement, confidentiality, opaque quality, informal management, and organisational slack (Harvey et al., 2016; Lewis and Brown, 2012; Von Nordenflycht, 2010).

In order to address the research question, we analysed the evolution of two service triads. The service providers were commissioned by a UK military 'buyer' to deliver a 'safety case' for a reconnaissance aircraft (i.e. a set of mandatory documents that identify, assess, and mitigate potentially catastrophic hazards before they cause an accident) for their customers (who operated the aircraft). Selecting a single case setting does not provide the confidence of a large *n* sample and inevitably raises concerns over generalisability, but two factors meant that this approach was deemed particularly appropriate for this study. First, accessing such commercially, technologically and militarily sensitive material would ordinarily be impossible but, tragically, on 2 September 2006, one of these aircrafts was lost, and its 14 crew killed while on a routine mission over Helmand Province in Southern Afghanistan. A public enquiry was held into the causes of the accident, and the report led by Haddon-Cave provides the basis for this analysis. The report covers a very broad range of issues, but it focuses in-depth [Part III, pp.163-340] on the specific service, involving two KIP service triads, to develop a safety case for the aircraft (Haddon-Cave, 2009). There was also significant ex-ante evidence of the

impact of knowledge asymmetries in the coordination and delivery of the services. For example, one supplier clearly leveraged their organisational reputation and more specifically, signalled to the customer (i.e. "opaque quality": von Nordenflycht, 2010, p. 161) that they were getting a thorough job by delivering large reports. Indeed, the appointment of a second advisory firm (as an independent advisor to the buyer) was intended to help overcome some of the worst of these knowledge asymmetries.

In sum, our case selection and sampling logic followed Pettigrew's (1990) suggestion to select polar types, and very few detailed cases are sufficient to investigate the cases in depth. The first triad (triad A) involved three actors: Royal Air Force (RAF, the service customer/operational client), The Ministry of Defense's Integrated Project Team (IPT, the service buyer), and BAE Systems (the professional service provider). In this triad, RAF had contracted BAE Systems for the provision of aircrafts. Moreover, IPT was also contracted by RAF to handle the procurement and management of the service. Finally, IPT had contracted BAE Systems to produce a safety case for Nimrod MR2 Aircraft XV230. We, therefore, refer to this as the contracted triad. This kind of buyer-supplier-customer triad has been prominently studied in the service triad literature.

The three actors in the second triad were: The IPT (service buyer), BAE Systems (the professional service provider), and QinetiQ (QQ, the professional service provider). This type of buyer-buyer-supplier service triad has received relatively limited attention in the service triads literature (Wu and Choi, 2005), even though their existence has been acknowledged by scholars (Wynstra et al., 2015). In this triad, IPT asked QQ to assume the role of an independent safety auditor to assess the safety case developed by BAE Systems. Of the three relationships in this triad, the only one with a formal contract was the IPT-BAE Systems relationship. Due to (relative) absence of formal contracts in this triad, we refer to it as the non-contracted triad. Examining this buyer-supplier-supplier triad, where two suppliers are delivering services to the

buyer, yet the performance of the service depends on their collaboration with each other, provides an interesting context to examine the manifestation of coordination failures in service triads (Choi and Wu, 2009b).

In spite of being structurally different, there were two important characteristics common to both of them. First, both triads were examples of service failures. Second, both triads had the same party holding the bridge position (Li and Choi, 2009; Wynstra et al., 2015). Our sampling strategy allowed us access to an appropriate setting consistent with our objectives, while also allowing us to control for any intervening variables.

3.2 Data sources

'Disasters' that cause or are created by organisational failures are of increasing interest to OSCM researchers (e.g. Gupta et al., 2016; Labib et al., 2019). The emergence of the sub-field of supply chain risk, for example, has been directly influenced by the impact of events such as the 2008 economic crisis or the Japanese Tsunami or Mattel's problems with lead paint (e.g. Chopra and Sodhi, 2014; Hora et al., 2011). Although a relatively new concern for OSCM, disasters and in particular man-made disasters such as the BP Deepwater Horizon, have long been of significant scholarly interest, in large part because they can lead to "alternative interpretations of events" (Gephart et al., 1990: p.30). Weick (1993), for example, used his analysis of the 1949 Mann Gulch fire to "re-examine our thinking about temporary systems, structuration, non-disclosure intimacy, intergroup dynamics, and team building" (p.628). Another aspect of such serious events is that they often result in official investigations that, in turn, generate extensive public domain reports that have been used as the basis for organisational research (e.g. Gephart, 1993; Turner, 1976). Brown (2000, 2004, 2005), for example, used official enquiry reports into the collapse of Barings Bank, the Piper Alpha oil rig disaster and the Beverly Allitt case to research institutional sense-making processes. The

use of secondary data sources has a long tradition in management research (e.g. Swan and Ettlie, 1997), but has only recently attracted more attention and calls in OSCM. For this study, we used the report: 'The Nimrod Review: An independent review into the broader issues surrounding the loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006'[1] as our main data source. The report took nearly four years to complete at a cost of more than £400,000.

Inevitably, this type of secondary data has limitations; not least the quasi-legal format of an official enquiry creates the potential for defensive and limited responses from key informants who are also potentially culpable. However, these concerns are outweighed by the advantages of secondary data research (Birkie et al., 2017; Stevenson and Cole, 2018). We draw on the richness and objectivity - achieved through the external verification process the data were subjected to during collection, analysis and presentation as data were collected and analysed by subject (i.e. military) experts - of secondary data sources for this research study. The official report, forming part of our dataset, was triangulated with a myriad of secondary data sources (please see Table 1 for a list of exemplary data sources). Triangulating additional data sources with the official report has further helped to gain insights concerning, for instance, both service triads, the organisations involved and their relationships. Moreover, additional data sources have helped to verify and check key findings, improving the study's reliability and validity.

[1] The report is publicly available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/229037/1025.pdf (accessed on 12 February 2020)

Table 1: Exemplary additional data sources *(sources accessed on 12 February 2020)*

Source	Year	Title	Link
The Guardian	2002	BAE shares take further plunge	https://www.theguardian.com/uk/2002/dec/12/military.baesystemsbusiness
National Audit Office	2003	Major Projects Report 2003	https://www.nao.org.uk/wp-content/uploads/2004/01/0304195.pdf
Human Factors 101	2006	Nimrod, Sept. 2006	https://humanfactors101.com/incidents/nimrod-sept-2006/
The Telegraph	2006	MoD 'ignored' safety warnings over Nimrod	https://www.telegraph.co.uk/news/uknews/1571458/MoD-ignored-safety-warnings-over-Nimrod.html
Flight Global	2006	Farnborough: BAE wins Nimrod MRA4 contract	https://www.flightglobal.com/news/articles/farnborough-bae-wins-nimrod-mra4-contract-208012/
The Guardian	2007	Fuel leak blamed for RAF Nimrod Crash	https://www.theguardian.com/uk/2007/dec/04/afghanistan.military
Board of Inquiry Reports (Archived)	2007	Board of Inquiry into the accident involving Nimrod MR2 XV230	https://web.archive.org/web/20090807195756/http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/BoardsOfInquiry/BoiNimrodMr2Xv230.htm
The Telegraph	2007	RAF 'knew about Nimrod leaks before crash'	https://www.telegraph.co.uk/news/uknews/1567403/RAF-knew-about-Nimrod-leaks-before-crash.html
The Guardian	2009	QinetiQ chief resigns after firm criticized in Nimrod crash report	https://www.theguardian.com/business/2009/oct/29/qinetiqgroup-baesystems
Independent	2009	10 named and shamed over Nimrod crash	https://www.independent.co.uk/news/uk/home-news/10-named-and-shamed-over-nimrod-crash-1810886.html

Source	Year	Title	Link
House of Commons (Haddon-Cove)	2009	An independent review into the broader issues surrounding the loss of the RAF NIMROD MR2 Aircraft XV230 in Afghanistan in 2006	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/229037/1025.pdf
Harris, R., EngD Thesis, Cranfield University	2009	Safety cases and safety culture	https://core.ac.uk/download/pdf/139708.pdf
BBC	2009	Cost cuts blamed for Nimrod crash	http://news.bbc.co.uk/1/hi/uk/8329117.stm
Independent	2009	'Lamentable' failures led to Nimrod crash that killed 14	https://www.independent.co.uk/news/uk/home-news/lamentable-failures-led-to-nimrod-crash-that-killed-14-1811133.html
The Telegraph	2009	Nimrod crash review: report criticises MoD and private companies	https://www.telegraph.co.uk/news/uknews/defence/6455331/Nimrod-crash-review-report-criticises-MoD-and-private-companies.html
Manchester Evening News	2009	Air Force chief slammed in crash probe	https://www.manchestereveningnews.co.uk/news/local-news/airforce-chief-slammed-in-crash-probe-933563
The Guardian	2009	Nimrod inquiry points finger: Flawed, sloppy, complacent	https://www.theguardian.com/commentisfree/2009/oct/29/nimrod-crash-inquiry-raf-afghanistan
Financial Times	2010	QinetiQ responds to Nimrod disaster report	https://www.ft.com/content/3bc0bcf4-3cd0-11df-89ca-00144feabdc0
Global Aviation Resource	2010	Aircraft History: The Nimrod MR.2 Leaves Royal Air Force Service	http://www.globalaviationresource.com/reports/2010/nimrod.php
YouTube	2013	The Hon Mr Justice Haddon-Cave - Piper 25	https://www.youtube.com/watch?v=y99_lhFFCsk

3.3 Data analysis

In order to produce a contextually detailed account of the case study, the data were carefully analysed in a multi-stage process; supported by the qualitative data analysis tool, TAMS (Text Analysis Mark-up System) Analyzer (www.tamsys.sourceforge.net/) with broadly similar functionality to QSR NVivo (Weinstein, 2006). As an illustration of the initial analytical process the total report - comprising 317,481 words – was first coded based on the definitional models discussed earlier and then subsequently in a more open fashion based on the researchers reading of the data. The analysis then entered a more iterative stage involving the creation of a number of meta-code sets, analysis of co-coding and the addition/further refinement of codes; cycling back and forth between the primary and secondary data and the literature (Miles and Huberman, 1994).

The software contributed to the process by producing word, code and co-code (i.e. text where more than one code was allocated) counts, permitting meta-code groups to be created, allowing for code searches against different text markers (e.g. 'BAE' versus 'QinetiQ' (QQ) responses) and producing software graphs summarising code patterns. Coding maps were used to support the process of creating meta-codes (i.e. via code aggregation and refinement/revision) and exploration of key interactions (i.e. overlapping codes/code sets and weak/strong co-coding).

In the second cycle of coding, focused coding based on the literature was performed on the report and the secondary data (Saldana, 2015) to develop the data structure (provided in Appendix A) and to explore the linkages between the coordination functions (steering and connecting) and the drivers and manifestation of coordination failures (Oliveira and Lumineau, 2017, 2019). Once the coding was completed, the authors held extensive discussions to resolve discrepancies regarding the interpretation of the phenomenon (Lawrence et al., 2016).

Secondary data (please see Table 1 for exemplary sources) were used for two purposes. First, they helped the researchers in familiarising themselves with the setting and state of the relationships before, at the time of, and after the disasters. Second, the data aided in corroborating evidence from primary data (Giudici et al., 2018).

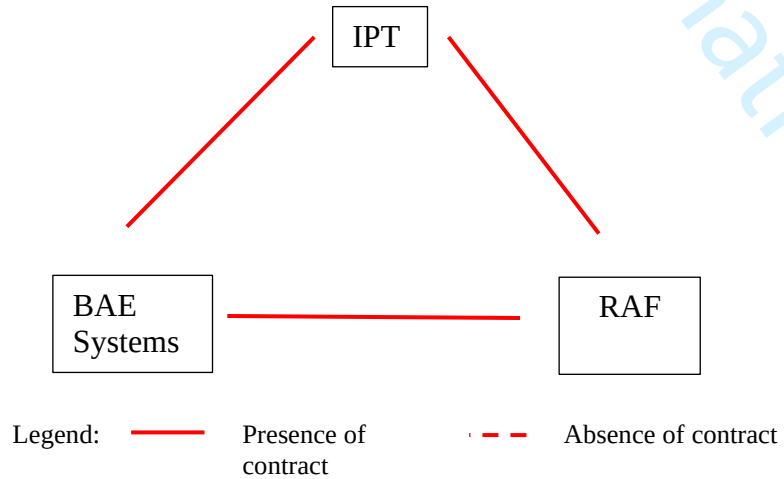
4. Within-case analysis

4.1 Triad-A (RAF-IPT-BAE Systems)

4.1.1 Steering function of coordination

In triad A (please see Figure 1), the service buyer, the Ministry of Defence (MoD)'s 'Integrated Project Team' (IPT), was the focal node and bridge between the KIP service supplier (BAE Systems, part of the firm who designed and manufactured the aircraft) and the operational client (the Royal Air Force (RAF) who flew the aircraft). Although the separation between buyer and customer, in this case, is a structural organisational one (given that both are public sector organisations) there is nonetheless a clear division of roles, responsibilities, location, and staff. RAF had multiple contracts with BAE Systems for the provision of aircrafts. Moreover, IPT was also contracted by RAF to handle the procurement and management of the service. Finally, IPT had contracted BAE Systems to produce a safety case for Nimrod MR2 Aircraft XV230.

Figure 1: Contractual structure of the service triad



Within the steering function of coordination, two activities were observed: goal setting and enforcing. From the RAF's perspective, it was clear that airworthiness of the aircraft was the most important criteria. In contrast, IPT was under internal pressure to achieve a 20% cost reduction across the board, including procurement. As noted by one of the IPT personnel: *"Costs were King. All IPT Leaders were held to account very, very closely and to keep within resource totals. It was a heinous crime to go above"* (Haddon-Cave, 2009: p325). Inevitably, IPT's emphasis on cost control reflected in the contract negotiation with BAE, *"'[…] The previous Chief of Defence Procurement, Sir Robert Walmsley, told us in January 2002 that from the Nimrod case there were lessons to learn about accepting too readily a bid from industry (BAE Systems in this case) which was going to be too technically demanding to deliver within the cost and time offered.'. Additionally, the fixed price contract, the consequent cost pressure and financial losses was said to have provided little incentive for BAE Systems to deliver"* (Haddon-Cave, 2009: p407). Negotiating a cost-focused contract reflects the bounded rationality of IPT's managers, as they prioritised their goals of cost reduction over their client's goal of quality. This is reflected in one of the key conclusions of the report, *"George Baber failed to give adequate priority, care and personal attention to the preparation of the NSC. He failed properly to utilise the resources available to him within the Nimrod IPT to ensure the airworthiness of the Nimrod fleet. He failed to give the NSC the priority it deserved. In doing so, he failed, in truth, to make safety his first priority"* (Haddon-Cave, 2009: p326).

IPT's goals of cost-reduction were enforced both internally (within the organisations) and externally (on its service-providers). First, all budget-reductions were made at the source, i.e., departmental budgets were reduced by 20% at the beginning of the financial year. The underlying assumption was that departments (and contractors) would come up with the ways to stay within the reduced budgets, failing which there would be a shortfall. Second, officers that delivered on the efficiency targets, irrespective of the adopted practices, were fast-tracked

to promotion. The enforcement of these goals was driven through a process-driven and hierarchical culture of the armed forces, as noted in the report: *"The strong impression one gets from the witnesses and the evidence is that the 'strategic goal' of 20% and other required financial savings were implemented across the board with a ruthless, if not 'Stalinistic', efficiency."* (Haddon-Cave, 2009: p376).

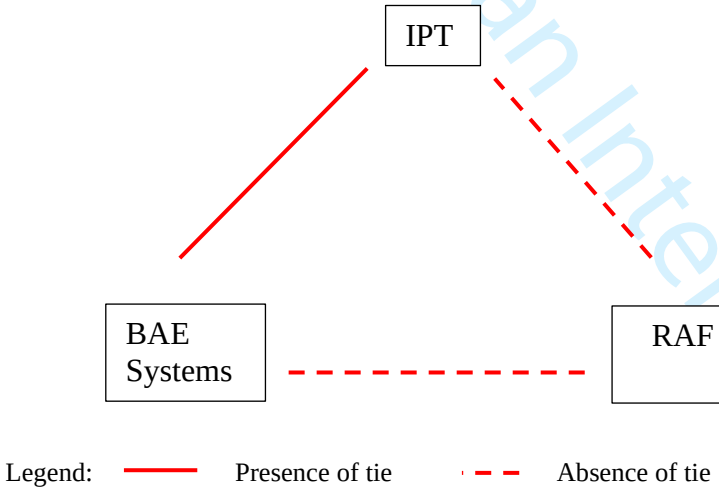
Enforcement of these goals led to the manifestation of opportunistic behaviour by BAE systems. For example, to meet IPT's enforced goals while maintaining profit, BAE systems resorted to practices such as cutting corners, budgeting for inadequate man-hours (and yet using fewer than budgeted man-hours), and deploying more junior professionals to deliver the service: *"When progress on Phase 2 fell behind, BAE Systems did not react appropriately: the IPT was not told and a suitable extension of the deadline was not sought; work became increasingly rushed and the quality of work suffered; corners were cut; inappropriate data was used to assess and sentence hazards; all the contractually required data was not used […] there was strong commercial motivation to finish the Nimrod Safety Case by the deadline at all costs (payment and prestige which BAE Systems hoped would lead to further similar work)"* (Haddon-Cave, 2009: p264). The source of the time pressure was clear, with notes recording him saying: *"[The IPT Lead] is ordering the sandwiches for the [completion] meeting already"*, the project was *"high profile"* and *"cannot afford to fail"* (Haddon-Cave, 2009: p224). As a result, on 16 August 2004, a change of approach was adopted, described by the enquiry as "plainly cutting corners", with the quality of analysis in certain areas deteriorating as time ran short. No evidence of constraining action was found in the triad, as RAF was not involved in the ongoing decisions. IPT, instead of asking for detailed information from BAE Systems, created a culture where repeated questioning and confirming was discouraged. For example, in one instance when BAE Systems *"asked for confirmation that he had understood correctly. This elicited a somewhat sarcastic response from Chris Lowe which confirmed he*

had understood correctly but did not disguise his irritation at Witness K [BAE Systems]: '...[your] continuous string of e-mails reminds me of a song called '...there's a hole in my bucket...''. This did little to improve relations between them." (Haddon-Cove, 2009: p221).

4.1.2 Connecting function of coordination

The prime role of MoD' IPT was to act as an integrator for the project to coordinate the activities within the triad (Oliveira and Lumineau, 2017). In other words, IPT was acting as a bridge between RAF and BAE systems (please see Figure 2). IPT acted as the main client of BAE Systems, and both parties had regular interactions with each other. In contrast, BAE Systems and RAF had very little interaction with each other, and RAF had outsourced the project management to IPT.

Figure 2: Relational structure of the service triad



The connecting function of coordination performed by IPT was analysed in terms of three connecting activities: monitoring, engaging, and liaising (Oliveira and Lumineau, 2017). For instance, IPT did not monitor BAE's activities and the output delivered. In fact, IPT's lack of

attention towards monitoring is evidenced by the fact that it delegated this task to a civilian, Frank Walsh, who was reportedly inexperienced and incompetent to undertake this critical activity (The Independent, 2009). In addition to this, his assessment of the risks was hurried and careless, and he did not seek guidance from his superiors when he was *"clearly out of depth and did not know what he was doing"* (Haddon-Cove, 2009: p319). For example, he did not refer to his superiors the hazards left 'open' and 'unclassified' by BAE system. Moreover, towards the end, he also reduced the ranking of risks marked 'remote' to 'improbable'.

The lack of proper monitoring by IPT meant that opportunistic behaviour by BAE Systems went unnoticed. For instance, the IPT Safety Manager agreed that BAE Systems had completed phase 1 of the safety case, acknowledging receipt of a *"populated but not mitigated"* Hazard Log (p212). BAE Systems was paid and, under the assumption that the "scope of the task is clear", asked to prepare a proposal for phase 2. Yet, a detailed reading of the six reports that accompanied the conclusion of phase 1 revealed that BAE Systems had left 40% of hazards open; all classed as having *"a potential catastrophic outcome"* (p246). Perhaps, as the enquiry report suggests, the sheer weight of the documents (a substantial *"thud factor"*; p290) was enough to assure the IPT that *"a substantial, and indeed thorough, job had been done"* (Haddon-Cove, 2009: p245). The knowledge asymmetry between IPT and BAE Systems also enabled deliberate obfuscation (Williamson, 1985). At an internal BAE Systems Meeting (17 September 2003) for example, it was agreed that one member of the team would *"draft some 'weasel' words relating to completeness of data-bases"* (Haddon-Cove, 2009: p214). Similarly, on 10 November 2004 after the delivery of the 6 reports, BAE Systems gave another presentation which reinforced the (false) impression that they had completed the safety case task, stating that the Hazard Log was 'fully populated'; and that all foreseeable hazards had been "identified and assessed, and addressed" (Haddon-Cove, 2009: p246).

In addition to the lack of adequate monitoring, data showed inadequate engagement from IPT and BAE Systems. It was found that IPT, driven by its cost and delivery pressures, ignored a number of recommendations by BAE Systems. For example, at the start of the project, BAE Systems recommended setting up of a Safety Case BAE Systems/Nimrod IPT working group *"to partake in the identification determine causes and effects and mitigation of all hazards, and contribute toward the consequent population of the hazard log"* (Haddon-Cove, 2009: p274). However, no such working group was set up by either BAE Systems or IPT. Furthermore, BAE Systems' advice pertaining to the fitting of fire-suppressing equipment following the reports of fuel leaks aboard RAF Nimrods was rejected by IPT (The Telegraph, 2007).

One of the IPT's core tasks was to ensure BAE Systems' work complied with RAF's requirements, i.e., RAF was involved in key decisions and any divergences were promptly and jointly resolved— a task (i.e., liaising) in which IPT failed. IPT, for instance, did not set up a joint working group and failed to ensure RAF's involvement: *"Safety Cases lack any, or any sufficient, input from operators and maintainers who have the most knowledge and experience about the platform […] Operators at RAF Kinloss were not even aware of the existence of the original Nimrod Safety Case"* (Haddon-Cove, 2009: p535). Furthermore, IPT was responsible for setting up an independent, formal advisor, which it failed to appoint. It did engage QinetiQ (discussed in the next case), but the task was never formalised: *"In my judgment, the Nimrod IPT failed properly to appoint an 'Independent Safety Auditor' (ISA) to audit the NSC, as required by Def-Stan 00-56 and JSP 553. The outcome might have been different if the IPT had ensured that an ISA had been properly appointed and tasked to carry out a full audit of the NSC"* (Haddon-Cove, 2009: p322).

The lack of engagement and liaising (on the part of both IPT and BAE Systems) was driven by two factors: dyadic inertia and unethical practices on the part of both actors. First, it

was observed that BAE Systems sought to satisfy the buyer (IPT) rather than its operational client (RAF). It was initially envisaged that there would be 'Operating Unit' representation throughout the process, but actual ties to the customer were very limited. It has been noted how limited the Zonal inspection visits were, but the enquiry also revealed that whilst there was initially good attendance at review meetings by representatives from the operating bases (i.e., RAF), this waned from mid-2003 onwards. In sum, IPT remained the bridge between BAE Systems and RAF, and the bridge was not transferred to BAE Systems or RAF, as would be necessary for managing the triadic relationships. Another reason for this could be that the relationship between BAE Systems and IPT was found to be too informal, and the dynamic would have changed if RAF was involved in the relationship: "*The bilateral relationship between BAE Systems and the Nimrod IPT […] with the former realising that it was unlikely to face much questioning of its work from the latter; the particular relationship between the key personnel at BAE Systems and the Nimrod IPT Safety Officer in charge of project managing the NSC task was altogether too cozy and informal*" (Haddon-Cove, 2009: p565).

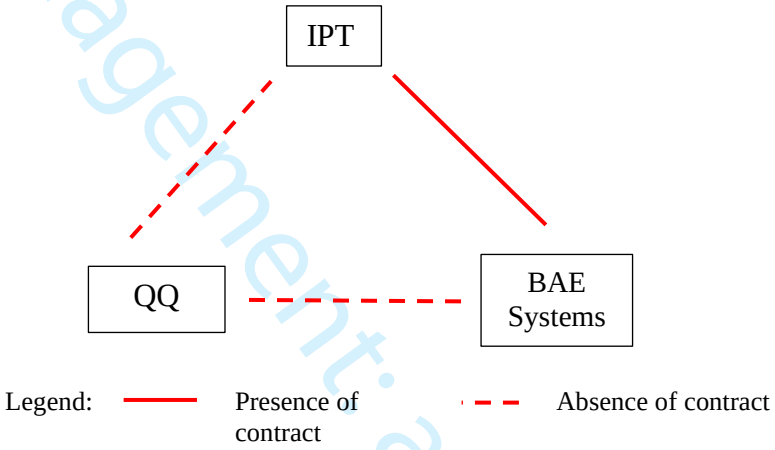
IPT's failure to involve RAF in the relationship (or appoint a formal ISA, discussed in the next section) could be attributed to their unwillingness to lose control over the service. IPT rejected a number of safety recommendations by BAE Systems: *"two years before the accident, the MoD did not act on a 2004 report by the manufacturer, BAE Systems, which recommended that a fire detection system be fitted in the bomb bay, where fuel leaks had occurred"* (The Guardian, 2007). The involvement of RAF, who valued airworthiness over budgetary concerns, would have led to further investigation into these concerns.

4.2 Triad-B (QQ-IPT-BAE Systems)

4.2.1 Steering function of coordination

In triad B (please see Figure 3), the IPT asked another established KIP service supplier, QinetiQ (QQ), to take on the role of an "Independent Safety Auditor". This buyer-supplier-supplier service triad (cf. Dubois and Fredriksson, 2008) had a more emergent structure (i.e. QQ was never formally tasked to be the "Independent Safety Auditor" but, rather over time, de facto assumed the role (Haddon-Cove, 2009).

Figure 3: Contractual structure of the service triad

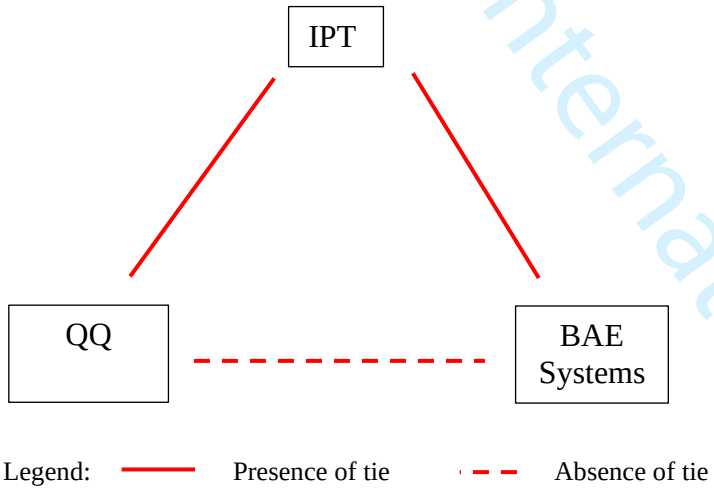


As compared to Triad-A (BAE Systems-IPT- RAF), this triad had only one contract (between IPT and BAE Systems). As discussed previously, IPT enforced its goals of cost reduction on BAE Systems using fixed-price contracts. The goal of cost-reduction was prioritised over arguably more important goals of safety and airworthiness. Since there was no formal contract between IPT and QQ, IPT used the threat of taking the business away from QQ to coerce it to rubber-stamp the safety case prepared by BAE systems. By doing this, IPT enforced its goal of cost reduction over QQ.

4.2.2 Connecting function of coordination

Due to paucity of formal agreements governing this triad, the role of the integrator (IPT) became even more critical. IPT was supposed to act as a bridge between BAE Systems and QinetiQ (QQ) to ensure that the safety case prepared by BAE was assessed and signed off properly, a task in which it failed. There was very little, if at all, interaction between BAE and QQ, and the relationship between IPT and QQ was not collaborative (please see Figure 4). Both IPT and BAE saw QQ as an unnecessary bottleneck in their work. Moreover, both BAE and QQ saw each other as competitors in a task where collaboration and information-sharing was essential: *"The triangular relationship between BAE Systems, the Nimrod IPT and QinetiQ: the former two clearly found the presence of the latter an unnecessary irritation and/or competition. As one contemporary observer said: 'it was obvious to me that QinetiQ was not seen as a partner in ensuring the aircraft or crew safety'. The two commercial entities are wary of each other as they compete for the favors of the customer and future business, and jealously guard their own birthright.*" (Haddon-Cove, 2009: p565).

Figure 4: Relational structure of the service triad



As an integrator, IPT had to perform three coordination activities: monitoring, engaging, and liaising (Oliveira and Lumineau, 2017). IPT was mainly concerned with ensuring that the safety case was delivered within budget and signed off at the earliest. Therefore, in addition to paying little attention to BAE's quality of work, it hindered QQ's monitoring of BAE's work: *"[…] he* (i.e., QQ's representative) *initially refused to support the completion of the task by BAE Systems on the grounds that he was only standing in and had not seen any of the key deliverable documents, the other attendees booed me and muttered things along the lines 'bloody safety engineers always have to caveat their statements'"* (Haddon-Cove, 2009: p331). Due to this, BAE was able to get away with withholding the documents from QinetiQ. This withholding of information and lack of monitoring also hindered IPT's engagement and liaising activities.

Both IPT and BAE tried to minimise QQ's involvement in the triad. As one of QQ's representative reflected, *"I felt that I was trespassing in a room where I really was not wanted"* (Haddon-Cove, 2009). Furthermore, the phase-I of the safety case *"had been produced without the appointment of an ISA, because the appointment of an ISA was a requirement of Def-Stan 00-56 when Class A and B risks were involved"* (Haddon-Cove, 2009). There was no evidence found for joint meetings and problem-solving. In fact, there was evidence that IPT effectively coerced QQ's compliance when it tried to raise issues. For example, during one of the meetings, Martin Mahy (QQ) raised the need for 'quantifiable targets' for the preparation of case, "*he received a somewhat hostile reception from the Nimrod IPTL, George Baber […] saying 'I do not need to get independent safety advice from QinetiQ, I can go elsewhere', referring to 'bloody QinetiQ' and saying 'QinetiQ is just touting for business'. […] Another member of the Nimrod IPT referred to the content of some of QinetiQ's reports as 'Tosh!' […] After the meeting, Martyn Mahy spoke to Frank Walsh who said he was surprised at the "viciousness" of the IPTL's comments about QinetiQ […]"* (Haddon-Cave, 2009: p216).

Following this *"carpeting"* (p216), QQ's priorities shifted. Anxious to maintain their relationship with the IPT, a meeting was arranged at QQ's request to *"clarify and defuse tensions"*. One witness at the enquiry claimed that Project Managers went to *"extraordinary lengths"* (Haddon-Cove, 2009: p217) and adopted a compromising stance to keep their client happy; including being prepared to modify their position: *"QinetiQ was anxious to remain on good relations with the Nimrod IPT and not to lose business. Accordingly, at QinetiQ's request, a meeting to 'clarify and defuse tensions' subsequently took place with the Nimrod IPT on 9 March 2004. […] QinetiQ appear to have acknowledged what may have been seen as over-zealous advice in the past by Witness L [QinetiQ] on a 'tie-wraps' issue but explained that he had left the company. […] The meeting seems to have been successful in smoothing things over"* (Haddon-Cove, 2009: p217).

Finally, QQ ended up signing off on work that they had not actually seen. BAE Systems withheld the safety case from QQ throughout, and IPT did not make any effort to ensure that the case was made available to QQ: *"It appears, however, that QinetiQ was not furnished with a copy of the Nimrod SMP. The reasons why not are not altogether clear. […] This is unfortunate because it was difficult to see how QinetiQ could properly perform its task (Task 010) of advising the Nimrod IPT on its Safety Management System (SMS), including the NSC, without a copy of the Nimrod SMP. A copy was not provided by the Nimrod IPT to QinetiQ until November 2007…"* (Haddon-Cave, 2009: p217). In sum, contrary to its role of being an integrator, IPT, at some points, appeared to be a barrier to coordination.

The next section provides a cross-case analysis of connecting and steering functions leading to coordination failures in the two investigated service triads.

5. Cross-case analysis

Having presented the key findings across coordination activities for each of the two investigated triads, this section compares coordination functions and activities across both triads (Table 2).

Table 2: Summary of coordination activities across Triad-A and Triad-B

Coordination functions	**Coordination activities**	**Triad-A**	**Triad-B**
Steering function	*Goal-setting*	▪ IPT prioritised its goals (cost and time) over that of RAF (airworthiness).	▪ IPT prioritised its goal of getting the safety case approved at the earliest (time) over that of QQ (quality). BAE goals were more aligned with IPT in this triad, as it needed the case to get their safety case approved (rubber-stamped).
	Enforcing	IPT enforced its goals of cost reduction by: ▪ Reducing procurement's budget by 20% at the beginning of the financial year. ▪ Promoting and fast-tracking officers delivering on efficiency targets	▪ IPT was able to enforce its goal over QQ by implicitly coercing it (the threat of taking the business away) to approve the case. ▪ As QQ wanted to keep IPT happy, it complied. Due to IPT's coercion, BAE Systems was able to get the safety case approved without ever submitting it to QQ.
	Constraining action	▪ Repeated questioning and confirming was discouraged by IPT ▪ RAF was not included in the approval processes and key decisions	▪ The whole system of sharing information and getting approvals was bypassed, as there was no contract to mandate sharing the information with QQ, and both IPT and BAE systems wanted to get the case approved without any delay.
Connecting function	*Monitoring*	▪ IPT could not monitor BAE Systems activity due to knowledge-asymmetry.	▪ IPT hindered QQ's monitoring of BAE System's work by unethically threatening to go to another safety auditor ▪ QQ was coerced into changing its position and approving the safety case without signing it ▪ QQ complied as it was anxious to not lose business
	Engaging	▪ IPT ignored BAE Systems recommendations regarding installation of more safety equipment on the aircraft and setting up of a safety case working group (involving all three parties).	▪ There was no evidence of any joint problem-solving, engagement or knowledge exchange activities within this triad. Instead, in the meetings, QQ's representatives was discouraged to ask clarification questions and *"booed"* at the meetings when they voiced concerns with the safety case.
	Liaising	▪ IPT did not liaise between RAF and BAE Systems to resolve deviations and did not set up an independent safety auditor.	▪ QQ was made to feel 'unwelcome' into the IPT-BAE System's relationship. BAE got away with not submitting its work to QQ for review.

5.1 Steering function failures of coordination in service triads

Setting up and enforcing goals is important for ensuring performance (Chun and Rainey, 2005). This becomes a complex endeavour in settings involving more than two parties because of the presence of multiple buyers and/or service providers. In triad A, IPT was responsible for setting up and enforcing goals on behalf of the operational client (i.e., RAF). It was, however, found that the goals sought by RAF (airworthiness) were different from that of IPT (cost and time). Since IPT occupied the bridge position in the triad, it was able to prioritise its own goals over that of the operational client. This was further complicated by the belief that since Nimrod aircrafts were operational for over 30 years, they were "safe anyway" and that the safety exercise "did not really matter", a view shared by BAE Systems (Haddon-Cove, 2009: p249). The assumption led to the safety case becoming a documentary exercise. *"The good track record of the Nimrod led to the prevailing 'high level of confidence' in the safety of the fleet. The view that the Nimrod was 'safe anyway' and 'acceptably safe to operate' blinded many of those involved in the Nimrod Safety Case"* (Haddon-Cove, 2009: p453). A similar pattern was observed in triad-B, where IPT prioritised its goals (cost and time) over QQ's goal of quality assurance. In this case, however, BAE Systems was more aligned with IPT, as both actors wanted the safety case to be approved without any delay or hassles.

In case of triad A, in addition to prioritising their goals over RAF's goals, IPT enforced its metrics of timely delivery and cost reduction for BAE Systems, which were inconsistent with the nature of work. The work expected by BAE Systems required far more resources and efforts than BAE was ultimately able to assign to this task, owing to increasing pressures to cut costs and turn profits in a contract that was designed to prevent them from doing so. BAE Systems ended up resorting to opportunistic behaviour to meet these goals. For instance, BAE Systems deliberately misled IPT and cut corners in terms of its quality of delivery. It was found that BAE Systems "*deliberately did not disclose to the Nimrod IPT or QinetiQ the actual*

percentage figures for the large proportion of hazards which it had left 'Open' and 'Unclassified' or otherwise draw attention to the large gap remaining in its analysis" (Haddon-Cove, 2009: p284). It also appointed professionals that were inexperienced and not capable to deliver the task. These professionals were *"insufficiently trained and experienced in Safety Cases and the techniques they were required to employ…"* (Haddon-Cove, 2009: p273). In addition to this, BAE's work lacked any real analysis and was found to be based on inappropriate data. It was also found that in Phase-I, BAE Systems utilised fewer man-hours than required, and made 26.1% profit (which was greater than the forecasted 12%).

In triad B, IPT enforced its goal of getting the report rubber-stamped at the earliest by QQ, by threatening to terminate the relationship. QQ, keen to win more business from IPT, complied despite its reservations. This enforcement further facilitated BAE Systems' opportunistic behaviour, as it withheld the safety case reports and the hazard logs from QQ. These hazard logs which would have enabled QQ to perform an independent safety audit. It also gave misleading information to QQ about the scale of hazards identified, ongoing progress, and tasks completed. In sum, BAE Systems was not open and transparent in presenting its work to IPT and QQ: *"BAE Systems gave the misleading impression to the Nimrod IPT and QinetiQ that the task had been properly completed and could be signed off and deliberately did not disclose to its customer the scale of the hazards it had left 'Open' and 'Unclassified' (many with only vague recommendations that 'further work' was required). The Nimrod IPT and QinetiQ representatives were lulled into a false sense of security. These matters raised question marks about the prevailing ethical culture at BAE Systems"* (Haddon-Cove, 2009: p16)

In sum, IPT, in pursuit of its goals of meeting cost and time targets, lost sight of more important goals of airworthiness and quality assurance. Its bridge position also played a part in facilitating the enforcement of these goals in triads A and B. Furthermore, opportunism was

found to be more pronounced in triad-A, as in order to meet IPT's goals of reducing cost and lead time, BAE Systems produced a safety case that was backed by inappropriate data. In conclusion, bounded rationality and opportunism caused steering failures in both triads, albeit they were more pronounced in triad A.

5.2 Connecting function failures of coordination in service triads

In triad A, the monitoring of BAE System's work was challenged by the knowledge asymmetry between the buyer and the service provider. For example, BAE clearly leveraged their organisational reputation (cf. Greenwood, 2007) as the design authority in this case and more specifically, ensured that the customer felt they were getting a thorough job ("opaque quality": Von Nordenflycht, 2010, p161) by delivering large reports. For instance, during the last two months in the lead up the customer acceptance conference at the end of August 2004, BAE Systems repeatedly assured the client that their work was on track whilst at the same time a series of internal review meetings flagged significant resource concerns, and that very few hazards had been "returned" (Haddon-Cove, 2009; please see sections 10A.137, 150, 151, 159, 161, 166, 176]. Despite these internal concerns, throughout phase 2, the IPT was given repeatedly misleading assurances about the progress of the work. Ultimately, it was decided to present the IPT with a summary, rather than a detailed review of the baseline reports and the contents of the hazard log. Ironically, the appointment of another KIP service supplier as an independent advisor to the buyer (leading to the formation of triad B) was intended to help overcome some of the worst of these knowledge asymmetries but, by failing to structure and engage properly with the governance dynamics of the service triad they were trying to create, the IPT never received any meaningful guidance: *"This was, on the face of it, a somewhat surprising "consensus" for the IPT and QinetiQ representatives to have been party to. […] At*

this stage, neither the IPT nor QinetiQ had actually seen all of the six NSC reports or 'deliverables'." (Haddon-Cove, 2009: p240)

This knowledge asymmetry was further exacerbated by the appointment of a relatively inexperienced manager, Frank Walsh, to monitor the progress of BAE's work. As found in the review, Frank Walsh did not have the qualifications, knowledge, experience or skills to monitor BAE's work. He was not trained in safety management and was not authorised to assess and assign risk scores. Furthermore, he had never worked on Nimrod before this assignment and therefore had no prior knowledge of the aircraft: "*It is not surprising that, most of the time, he was clearly out of his depth and did not really know what he was doing"* (Haddon-Cove, 2009: p327). As Frank Walsh came to realise his errors, instead of alerting his superiors, he tried to hide them: "*Frank Walsh had realised that these 40 hazards could not simply be left as 'remote' but had to be 'managed' down to "improbable" in order to justify the assertion of ALARP. I find that he did this entirely on his own and without the knowledge of either Michael Eagles or George Baber. Again, in my judgment, Frank Walsh should have alerted his superiors to this matter which he had overlooked. The fact that he did not see fit to do so is, again, regrettable and unfortunate."* (Haddon-Cove, 2009: p320) Clearly, the appointment of a more qualified, knowledgeable, and experienced professional would have reduced some of the monitoring problems caused due to knowledge asymmetry.

In addition to knowledge asymmetry, the monitoring problems in both service triads were further exacerbated by dyadic inertia. In triad-A, for example, IPT failed to include RAF operators in triad-A, who had the knowledge and technical expertise to evaluate BAE System's work. BAE System also focused more on maintaining its relationship with and satisfying IPT over RAF. In triad-B, both IPT and BAE Systems were unable to include QQ in the monitoring of BAE Systems work. This was interesting because the whole purpose of BAE System's inclusion in the service triad was to monitor BAE System's work. IPT saw BAE System as an

unnecessary hurdle in the timely completion of work, and BAE Systems withheld information from QQ and did not submit the safety case to QQ for inspection.

Dyadic inertia also created issues for liaising activities. In triad-A, IPT did not work with RAF to get early input into the safety case. In fact, a number of RAF operators were not aware of the development of a safety case. Similarly, IPT failed to involve a formal and independent safety auditor from the beginning and ended up informally appointing QQ as a safety auditor at a later stage (triad-B). Due to its lack of formal engagement, QQ was unable to evaluate the safety case and potentially enforce the required practices over BAE Systems to evaluate its quality of work. It appears that it was a deliberate attempt to keep QQ's role limited in the triad: *"The reason why* (QQ's role as the ISA was) *not* (formalised) *is due to a curious mixture of oversight, assumption and reluctance: oversight regarding carrying out the formalities; the assumption that QinetiQ was already tasked and acting as ISA; and reluctance by the Nimrod IPT to allow QinetiQ to become too involved"* (Haddon-Cove, 2009: p322). In sum, the monitoring of BAE System's work was constrained by two issues: knowledge asymmetry and dyadic inertia. Furthermore, dyadic inertia particularly constrained IPT's liaising activity.

Unethical practices constrained IPT's engagement activities in both triads. In triad-A, MOD-IPT deliberately ignored RAF's recommendation to fit an early warning system in all Nimrods, which would alert the crew to hot-air leaks. IPT dismissed the prior incident report and the recommendation, calling it "unnecessary and impractical". Moreover, it rejected BAE Systems recommendation to install fire suppression equipment in the planes' bomb bays, which were made after reports of fuel leaks aboard the Nimrods. MoD referred to these recommendations as "not appropriate" and "unlikely to be effective" (Telegraph, 2007). IPT's intentional rejection of these recommendations reduced the safety of the aircraft. It used its position as the bridge of the triad to make unanimous decisions.

In triad-B, unethical behaviour was found to much more pronounced in comparison to triad-A. In this case, IPT used its authority to coerce QQ to sign off the report despite its reservations. IPT treated QQ's concerns with hostility and subtly threatened them with the possibility of being replaced by another auditor: *"Martyn Mahy recalls George Baber saying 'I don't need to get independent safety advice from QinetiQ, I can go elsewhere' [...] The minutes record George Baber requiring 'an essential change to the QQ reports' because QinetiQ were 'not currently offering advice that he felt was needed' or 'value for money'"* (Haddon-Cave, 2009: p216). In sum, it follows that IPT kept its own interests above that of each of its stakeholders, and engagement and joint problem solving with its client as well as suppliers could have prevented this incident.

In sum, IPT was unable to monitor BAE systems' work due to knowledge asymmetry between the parties. Furthermore, dyadic inertia, coupled with unethical behaviour on part of IPT and BAE Systems, led to the third actors in both triads (RAF and QQ, respectively) not being connected to the triad. The practice of unethical behaviour was found to be more pronounced in triad-B, as there was no formal agreement between IPT and QQ. IPT, therefore, bore no risk in switching suppliers. IPT was able to use this to its advantage and coerce QQ into rubber-stamping the safety case despite its concerns. In conclusion, knowledge asymmetry, dyadic inertia, and unethical behaviour caused connecting failures in both triads, albeit they were more pronounced in triad B.

6. Discussion

Contracted service triads are steered through three activities: goal-setting, enforcing, and constraining-action (Oliveira and Lumineau, 2017). The objective of these activities is to steer the service triad towards a common goal. However, in a service triad, all three organisations could have different goals (as seen in our cases). Our findings illustrate that bounded rationality

of the integrator may lead to prioritisation of its goals over that of the customer. Since, the integrator may enjoy the benefits of the bridge position (Li and Choi, 2009; Wynstra et al., 2015), it may lead to setting-up and enforcement of its own goals over that of the operational client. The presence of a structural hole between the service-provider and the operational client seemed to encourage the service-provider to prioritise satisfying its immediate customer (i.e., the integrator) over the client. This situation might be further supported by the lack of information flow from the service-provider as the client may be unaware of this situation. The presence of this structural hole may encourage opportunistic behaviour by the service-provider. This is because the operational client is not connected to the other actors in the triad to enforce its goals, and the integrator is able to enforce its divergent goals in the triad. Faced with this conflicting choice, it becomes easier for the service provider to prioritise the goals of the enforcer. Also, since integrators are generalist coordinators and not subject matter experts (Roehrich et al., 2019), they are often not the best judge of knowledge-intensive work. This further creates issues of monitoring knowledge work. In sum, this bounded rationality by the integrator and opportunism exhibited by the service provider are manifestations of the 'dark side' of the phenomenon of *tertius gaudens*, where the presence of a bridge position and a structural hole could be counterproductive for the triad (Li and Choi, 2009; Wynstra et al., 2015).

The connecting function of coordination in contracted service triads is performed through three activities: monitoring, engaging, and liaising (Oliveira and Lumineau, 2017). In the context of knowledge-intensive/ professional services, knowledge asymmetry between the integrator and the service provider presents challenges for monitoring work. Without sufficient knowledge of the work, monitoring activities such as checking the progress of work and quality checks would not reveal non-conformance. This issue could be (potentially) overcome by involving the operational client in the monitoring activities. The client, with its prior

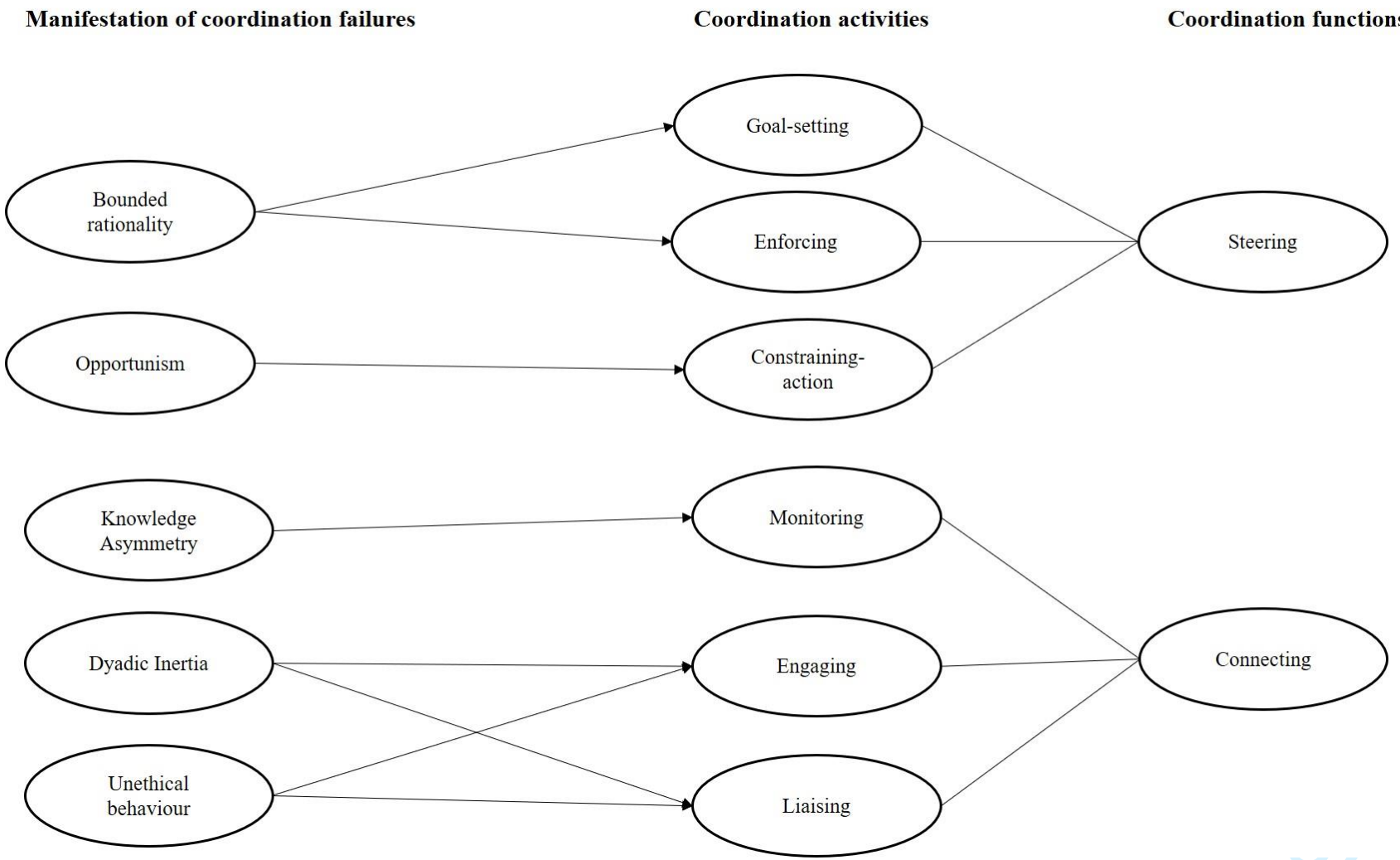
knowledge of the context of work, could be in a better position to identify any early signs of quality issues. Also, the client may be able to provide early and ongoing inputs into the service provision. This departs from the traditional conceptualisation of professional services, where an 'expert' consultant is interacting with a less knowledgeable client. As knowledge asymmetry between the client and consultant decreases, the (operational) client plays a more active role in diagnosis and problem solving process (Nikolova et al., 2009). The involvement of the operational client, however, is dependent on the integrator's liaising activities. These activities could be inhibited by the integrator's (or the service provider's) unwillingness to engage the operational client, thus creating dyadic inertia (Kim et al., 2006). Finally, engagement activities, involving joint problem solving and development of mutually agreed solutions, are one of the most important activities performed by the integrator. These activities, however, could be constrained by unethical practices such as deliberate rejection of proposed solutions by the service-providers in the interest of achieving short-term goals such as cost reductions.

The role of the connecting function of coordination in service triads becomes particularly pronounced in non-contracted service triads (Caldwell et al., 2017). In addition to the issues of knowledge asymmetry, an integrator's unethical use of coercion could further inhibit the monitoring of knowledge work. Since the roles and responsibilities of the organisations within the service triad are not contractually defined, the integrator could use its bridge position to restrict information flow between the other two parties, and exerting undue pressure on the actors to comply with the integrator's demands, thereby compromising task quality. This would also send the wrong signal to the opportunistic service provider to withhold potentially the required information from the other KIP service supplier (even more so since it is not contractually obliged to share information) and deliberately mislead them (both the client and other service supplier) about its work quality and progress. In other words, in the absence

of formal contracts, the adoption and enforcement of ethical practices by the integrator are important for the connecting function of coordination in non-contracted service triads. In sum, while steering failures in service triads are linked to bounded rationality and opportunism exhibited by actors in service triads, the connecting failures are linked to knowledge asymmetry, dyadic inertia, and unethical behaviour (Oliveira and Lumineau, 2019). These linkages are illustrated in Figure 5.

Recent literature has argued that in transitive service triads, where there are no structural holes and all actors have direct ties with each other, all three actors have a shared responsibility for coordination (Bastl et al., 2012, 2019; Karatzas et al., 2016). In our study, we found that in both triads IPT remained the bridge, which not only gave it informational and control benefits (Li and Choi, 2009), but also placed the responsibility of coordinating the two triads on IPT. As IPT wanted to ensure that its goal of cost reduction was prioritised over goals more important to other actors (such as airworthiness and safety), it did not perform the steering and connecting functions adequately. IPT also ensured that it retained the bridge position by maintaining structural holes in the two triads.

Figure 5: Manifestation of coordination failures in service triads



7. Conclusions

Prior research in service triads has traditionally emphasised the importance of one actor in controlling activities, generally the occupant of the bridge position (Li and Choi, 2009). It has also emphasised positive outcomes. Our objective in this paper was to examine how steering and connecting coordination failures manifest in service triads. The interdependence of activities inevitably creates issues in terms of service specification and performance attributability, as service contracts are primarily structured on a dyadic level (Bastl et al., 2019; Roehrich, Selviaridis, et al., 2020; Selviaridis, 2016; Selviaridis and Norrman, 2014). While extant studies on managing service triads have paid most attention to controlling relationships (e.g. Li and Choi, 2009; Van der Valk and Van Iwaarden, 2011), our study highlights the impact of coordination dysfunction. Furthermore, by examining steering and connecting coordination functions (or lack thereof) in contracted and non-contracted arrangements, we reveal a different emphasis on coordination activities in each case.

Our research has important implications for policy and practice. The case shows how outsourcing relational governance to system integrators can lead to dysfunction with the integrator prioritising its' goals. Governments will continue to use integrators to deliver complex projects but, as the ultimate client, they should still seek to arrange formal and informal governance mechanisms with their service providers. For organisations that outsource service 'coordination' our findings serve as a particularly cautionary tale, they should think very carefully before relinquishing the bridge position to a supplier. Moreover, all parties involved in triadic arrangements should actively guard against knowledge asymmetry, dyadic inertia, and unethical practices.

Inevitably, our selected research approach and type of data have limitations. However, this concern must be set against the richness of the documentary evidence; especially in a context where the alternative is no public data/research at all. Further research into successes

and failures of different service triads may prove a fruitful future research avenue. Extending the range and number of service triads 'types' that are studied (e.g., contracted and non-contracted, different knowledge assets, professions, organisational structures, countries, sizes, etc.) will also clearly enhance the validity and generalisability of any findings.

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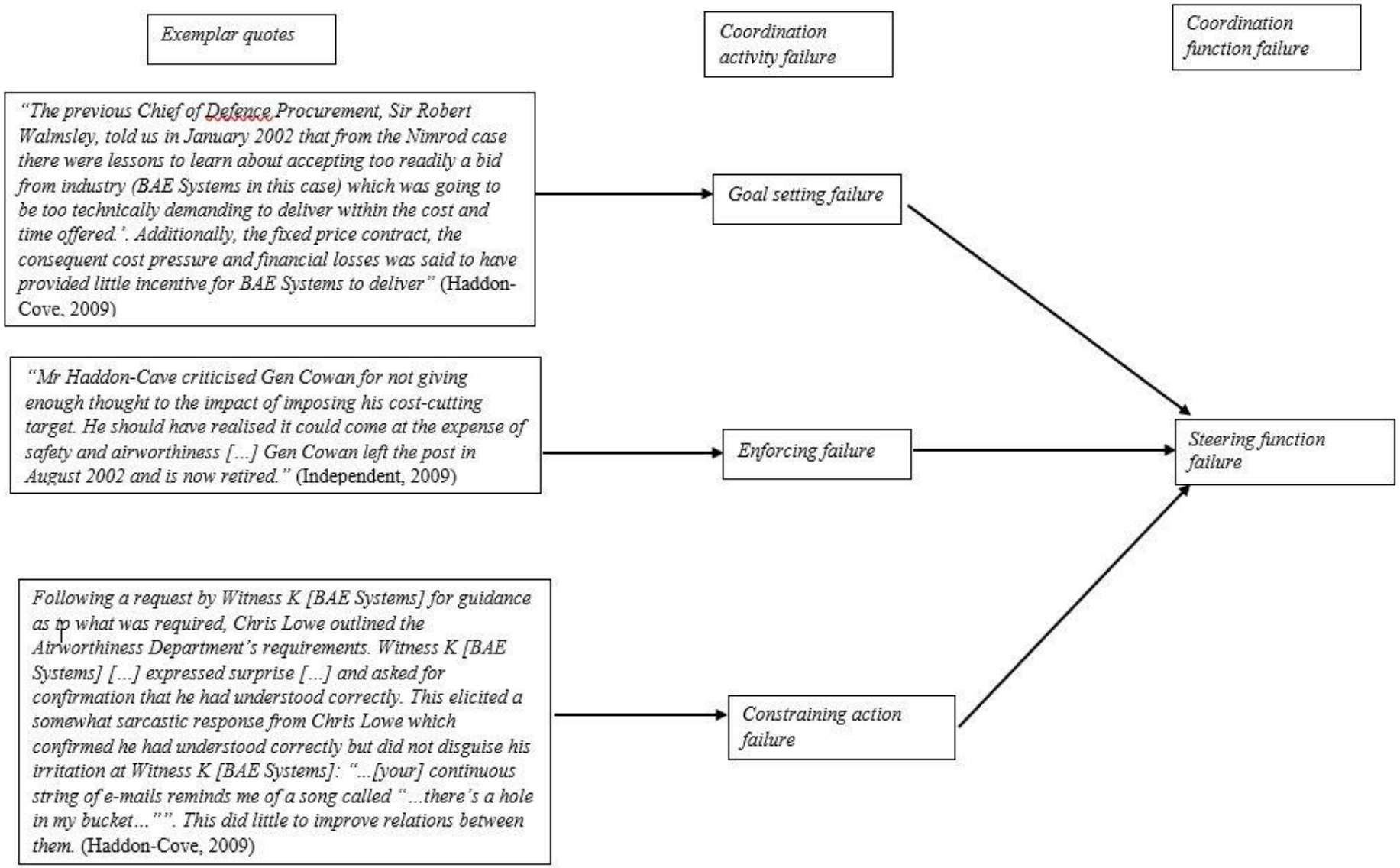
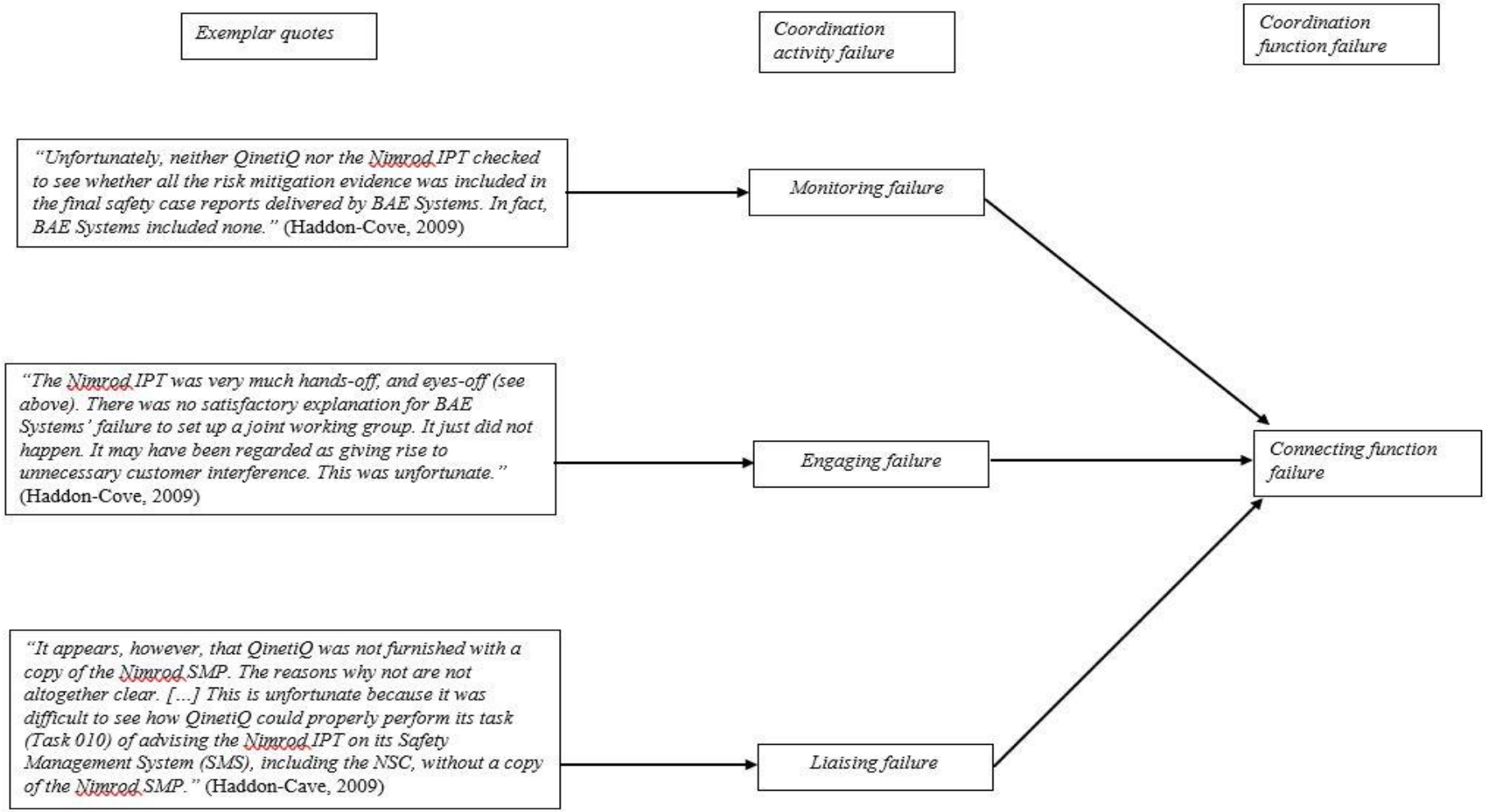
APPENDIX A: Data structure across cases


Exemplar quotes
Coordination activity failure
Coordination function failure
"The previous Chief of Defence Procurement, Sir Robert Walmsley, told us in January 2002 that from the Nimrod case there were lessons to learn about accepting too readily a bid from industry (BAE Systems in this case) which was going to be too technically demanding to deliver within the cost and time offered.'. Additionally, the fixed price contract, the consequent cost pressure and financial losses was said to have provided little incentive for BAE Systems to deliver" (Haddon-Cove, 2009)
Goal setting failure
"Mr Haddon-Cave criticised Gen Cowan for not giving enough thought to the impact of imposing his cost-cutting target. He should have realised it could come at the expense of safety and airworthiness [...] Gen Cowan left the post in August 2002 and is now retired." (Independent, 2009)
Enforcing failure
Steering function failure
Following a request by Witness K [BAE Systems] for guidance as to what was required, Chris Lowe outlined the Airworthiness Department's requirements. Witness K [BAE Systems] [...] expressed surprise [...] and asked for confirmation that he had understood correctly. This elicited a somewhat sarcastic response from Chris Lowe which confirmed he had understood correctly but did not disguise his irritation at Witness K [BAE Systems]: "...[your] continuous string of e-mails reminds me of a song called "...there's a hole in my bucket..."". This did little to improve relations between them. (Haddon-Cove, 2009)
Constraining action failure


Exemplar quotes
Coordination activity failure
Coordination function failure
"Unfortunately, neither QinetiQ nor the Nimrod IPT checked to see whether all the risk mitigation evidence was included in the final safety case reports delivered by BAE Systems. In fact, BAE Systems included none." (Haddon-Cove, 2009)
Monitoring failure
"The Nimrod IPT was very much hands-off, and eyes-off (see above). There was no satisfactory explanation for BAE Systems' failure to set up a joint working group. It just did not happen. It may have been regarded as giving rise to unnecessary customer interference. This was unfortunate." (Haddon-Cove, 2009)
Engaging failure
Connecting function failure
"It appears, however, that QinetiQ was not furnished with a copy of the Nimrod SMP. The reasons why not are not altogether clear. [...] This is unfortunate because it was difficult to see how QinetiQ could properly perform its task (Task 010) of advising the Nimrod IPT on its Safety Management System (SMS), including the NSC, without a copy of the Nimrod SMP." (Haddon-Cave, 2009)
Liaising failure