Outcome-based Contracts as a driver for Systems thinking and Service-Dominant Logic in Service Science: Evidence from the Defence industry[1]

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Outcome-based Contracts as a driver for Systems thinking and Service-Dominant Logic in Service Science: Evidence from the Defence industry[2]

Abstract

Two outcome-based defence contracts are studied in the attempt to better understand the provision of services in maintenance, repair and overhaul (MRO) environment that is contracted on the *outcome* of the equipment, rather than the provision of equipment. The nature of the contract changes the dynamics of the delivery, bringing complex issues such as customer behaviours and involvement to the forefront, with both customer and firm focused on value co-creation and co-production, rather than each party's contractual obligation. We uncover four areas that are crucial in the understanding of value co-production in service delivery and analysed them through a systems approach combined with the application of the service-dominant logic, both considered as the theoretical underpinnings of service science.

Keywords: Systems thinking, Service science, Outcome-based contracts, Value co-creation, Service-Dominant Logic

Introduction

Outcome-based contracting, or its narrower equivalent of performance-based contracting, is a contracting mechanism that allows the customer to pay only when the firm has delivered outcomes, rather than merely activities and tasks (Ng and Yip 2009). If one considers the famous quote from Levitt where "the customer really doesn't want a drilling machine, he wants a hole in the wall", outcome based contracts considers the possibility of customers paying only for holes in walls, when buying a drill (Levitt 1972). While this might still be a little far-fetched for consumer goods, the idea of contracting on outcomes in B2B service contracts is increasingly possible. This is the case for Rolls Royce "Power-by-the-hour®" contracting for the service and support of their engines, where the continuous maintenance and servicing of the engine is not paid according to the spares, repairs or activities rendered to the customer, but by how many hours the customer obtains power from the engine. Outcome-based contracts have been shown to provide huge cost efficiencies to customers as both the firm and the customer's objectives become much more aligned (Ng and Yip 2009). In essence, outcome-based contracts drives home the concept of value-in-use, where value is defined as the benefit the customer obtains through use (Vargo and Lusch 2004a; Vargo and Lusch 2008), and compels the firm to bring in customer usage as part of its responsibility to deliver the outcome.

Bringing in the customer as part of outcome-based contracts may sound intuitively appealing, but pose immense difficulties on delivery. For example it is often not possible to deliver an outcome without the customer co-creating or co-producing the service with the firm. In the case of the hole-in-the-wall, the firm can't deliver the outcome without the customer knowing how to use the drill in the first place. Thus, the role of the

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customer within the firm's delivery space requires new ways of thinking of the firm's governance and the design and delivery of the service under outcome-based contracts. The need to deliver outcomes also drives the need for the functions such as marketing, IT, engineering, operations, OB/HR and strategy to be much more integrated and aligned towards delivering the benefit to the customer, rather than being individually focused on their own set of activities.

Consequently, the understanding of outcome-based contracts would advance the new discipline of service science, defined as "an integrative discipline of engineering, technological and, social sciences …for the purpose of value co-creation with customers" (Ng and Maull 2009). Lohr describes "service science" as a hybrid field with a purpose to use "technology, management, mathematics and engineering expertise to improve the performance of service businesses" as well as service functions like "marketing, design and customer service" that are crucial in manufacturing industries (Lohr 2006). Yet, there is acknowledgement amongst researchers that the hybrid field is not a result of reconciling multi-disciplinary perspectives but to investigate service phenomenon under an integrative umbrella of *service system* which, according to Spohrer et al (2007), can be defined as a "value co-production configuration of people, technology, other internal and external service systems and shared information such as language, processes, metrics, prices, policies and laws". The delivery of an outcome-based contract would be an ideal setting through which a service system could be evaluated. Insights into delivering on an outcome-based contract could therefore provide frameworks necessary to advance knowledge in service science and service system.

This paper reports on a study of two outcome-based contracts in the defence industry. Our study shows how outcome based contracts are an excellent example of organisations moving from Goods-Dominant logic to Service-Dominant logic, the latter considered as a theoretical underpinning of service science. Our study also reports the challenges in moving from the two logics which we analyse from a systems perspective, demonstrating the importance of systems thinking in driving knowledge in service science.

The discussion of this paper proceeds as follows. After a review of related literature in section 2, we present our methodology and our analysis in section 3 and 4 respectively before concluding with a general discussion in section 5.

Literature Review

Extant literature on service is at a relatively youthful stage with some work surfacing in the early 1960s. Yet, the literature is already burdened with different concepts, theories and application both by the business and research communities. Much of this confusion has been attributed to two reasons. First, the word "service" is used extensively with multiple meanings in our daily conversations. Terms such as "customer service", "service charges" and "service centres" are common everyday expressions, yet what exactly is meant by these expressions are very much an intuitive interpretation by the user.

Second, in an effort to unify the study of services, the lack of an accepted definition for the word "services" amongst the services research community has resulted in numerous

debates on the legitimacy of its research (Heineke and Davis 2007; Thomke 2003). In recent years, these continued and unsolved debates have lead Vargo & Lusch to suggest that this difficult discussion on the definition for services has been "more abandoned than resolved" (Vargo and Lusch 2004a). This implies that despite commendable and substantial amount of published literature on this subject over the last thirty years, very little is understood of services at an abstract level to encourage common understanding of services research. Today, we find service research being pursued by various academic disciplines, with each examining different meanings within specific contexts. This ubiquitous nature of services research has to an extent, fragmented the service research community.

Service Science. In response to the fragmentation, IBM coined and championed the concept of "Service Science, Management and Engineering" (SSME) in order to develop an interdisciplinary and intercultural approach to service research (Spohrer and Maglio 2005). On their website, they call for an integration of four different schools; business management, engineering, social sciences and information systems. These schools represent a diverse set of academic disciplines such as marketing, operations management, accounting, operations research, information systems, engineering, economics and psychology.

From an academic standpoint, service science offers a platform for the development of a new discipline equipped with its own set of curricula. A consensus is emerging that service cannot be described and understood by a single academic discipline (Glushko 2008). Thus, service science can be defined as an integration of various disciplines such as management, engineering, accounting, finance and operations, with the aim of preparing the next wave of innovators in contributing to a service economy. Service science aims to develop a general "theory of services with well defined questions, tools, methods and practical implications for society" (Spohrer et al. 2007). However, in order to better understanding of the study of services under the concept of service science, there is a need for a dramatic shift from a goods-dominant logic to a service-dominant logic as proposed by Vargo and Lusch (2004). The service-dominant logic primarily argues that goods (tangible) are appliances used in service provision, and goods and service have a nested relationship. They suggest that economic exchange is fundamentally about service provision; in short, everything is a service. As such, they argue that customers are always "co-producers and co-creators" of value when compared to the traditional view of products where the firm and consumer are separated upon the purchase. As such, it appears that the customers' roles are now moving from being isolated to being connected to the firm, changing from passive to active and from being unaware to being informed. By this overlapping of the customer's roles in the firm's processes, organisations are beginning to recognise its interdependence with the customer.

Within such thinking, firms do not really provide value, but merely value propositions (Vargo and Lusch 2004a) and it is the customer that determines the value and co-creates it with the firm. Thus, value co-creation under the service-dominant logic is a critical theoretical foundation in the understanding of service science, as put forward in the first

issue of the service science journal (Vargo and Akaka 2009), as well as in recent papers by Maglio and Spohrer (2008).

Finally, the concept of service science appears to be at the intersection of various academic disciplines and this suggests strong interdisciplinary research. Insights drawn from interdisciplinary theory as argued by Newell proposes that complex systems and phenomena are necessary conditions for an interdisciplinary approach to the research problem, adding that the issues examined must be "multifaceted and coherent" in order to justify such an approach (Newell 2001). An interdisciplinary approach is necessary to understand service as a whole, as well as balancing the need to preserve the contributions entities make to the Service ecosystem both in terms of interdisciplinarity in research and inter-functionality in practice, whilst making sense of the relationships between them across disciplinary and functional boundaries. This is particularly relevant when embracing the concept of value co-creation, where customers bring their resources to bear on value co-production and co-creation. Disciplines such as engineering, operations, ICT and even management, although aspire to be customer and value focused, often make certain exogenous assumptions about 'customers' and 'value' specifications and while the terms may sound the same, the meanings attached to them differ across disciplines (Ng and Maull 2009). This complicates the understanding of value co-production and co-creation with different disciplines assuming various degrees of customer involvement, as well as specifying the customer characteristics quite differently across different research and practice contexts. A different philosophical and conceptual paradigm that transcends disciplinary agendas must therefore be employed in the understanding of service. We argue that a systems approach is a way forward to advance knowledge in service science.

Service research has a history of interest in service systems (Chase 1978; Wemmerlov and Hyer 1989) although the term was not strongly defined and negligible attention was paid to the underlying premises of systems theory. More recently, the developing theory of service science has renewed the interest in the study of service systems (Demirkan and Goul 2006; Spohrer et al. 2007), with researchers increasingly using a systems approach towards the understanding of internal structures (intra-entity service) and external structures (inter-entity service) that exist to support the value co-production and co-creation process. This dynamic configuration of people, technology, and organizations emphasise that in a service system, the "whole" system is the primary unit of analysis and *interactions* between the components of the system (the employees, customers, technologies and other resources) are just as important as the components themselves within the system that should be configured for *effective* as well as *efficient* co-creation and co-production of value with the customer (Ng and Yip 2009). The more complex the service system, the more important become the relationships amongst the components, comprising employees and customers, materials and equipment information and technologies for as argued by Vargo and Lusch (2008) all social and economic actors are resource integrators".

Clearly, the study of service systems is also critical in our understanding of service science as echoed by Maglio and Spohrer (2008). Yet, to understand what a 'system' means, a literature review on systems thinking is required.

Service Systems. Systems theory has contributed substantially to the foundation and development of many disciplines such as biology, sociology, psychology, information processing and engineering. For instance, systems thinking has presence in the study of biology through an established movement known as "systems biology" that studies complex interactions in biological systems (Naylor and Cavanagh 2004) and in psychology, there is a long tradition of research in what is known as "Gestaltism" which examines the holistic function of the brain and proposes that the "whole" is different from the "sum of the parts". Similarly in sociology, Parsons developed theories using systems theory and cybernetics to postulate that social systems treated in behavioural science were "open," meaning that they were embedded in social structures consisting of other systems (Parsons 1971).

From a broad perspective, "systems" can be defined as an "entity which is a coherent whole". This coherence enables a boundary to be drawn around an entity distinguishing the elements that are "inside" from the "outside". Within this entity, there is a mechanism of control which enables the entity to keep its identity. Also, the existence of a boundary enables us to identify inputs and outputs that crosses the boundary. All these elements of the system that function together show some level of organisation beyond that of the random or weakly related. Therefore, an entity considered as a "whole", has sub-systems and is part of a wider whole (Checkland 1981).

In applying Checkland's definition of systems there are five main elements comprising (a) coherent whole, (b) boundary, (c) mechanism of control, (d) inputs and outputs and (e) sub-systems and wider whole, we can identify a complex service system at the level of the whole organisation. For example, an organisation is a coherent whole that is a legal entity that has boundaries that are definable in law. The organisation then has managers that act as control mechanisms, taking inputs and producing products and services as outputs. Within these mechanisms, there are various sub-systems (e.g. departments). As a whole, the organisation exists within a higher level economic system or sometimes within a broader supply chain.

Employing systems thinking under this context offers the researcher a number of higher level concepts that needs to be considered extensively. Among them are the open and closed systems (Bertalanffy 1972), socio-technical systems (Emery and Trist 1960), the law of requisite variety (Ashby 1958), viable systems model (Beer 1984) and systems dynamics (Forrester 2003). These are explained in appendix A and will be used to analyse the two contracts reported in this study.

< Take in Table>

Our thesis thus far has been to review the systems approach and its applicability in service science, particularly in light of advancing knowledge in value co-production and

co-creation. The need for better knowledge in value co-production is much more pressing in the service delivery of outcome-based contracts as we would now explain.

Outcome-based Contracts. Traditional MRO contracts are contracted under a MRO service level agreement where the cost of spares could be excluded, or where spares are included in the price (Van Weele 2002). The contractor could also provide a cost-plus contract provide detailed costs structures (inclusive of a schedule of cost of spares) to the customer to determine reimbursement with a profit percentage that has been pre-determined (Kim et al. 2007). Recently, there have been a growing number of MRO contracts that focuses on outcomes of equipment rather than the tasks involved in the provision of the equipment. Called Performance-Based Logistics (PBL), this mode of contracting is starting to re-shape how MRO service contracts are being formed. In essence, PBL is about contracting on performance, rather than tasks or inputs by the service provider. For example, in the case of Rolls Royce, the service provided to maintain engines is being remunerated on the basis of how many hours the engine is in the air – a concept known as 'power by the hour®'. As an analogy, imagine being paid to deliver English lessons to a student not in terms of the number of lessons, materials etc. but on the basis of how many English words is used by the student after the lessons are over. Such outcome-based contracts focus on achieving required outcomes rather than a contract for the supply of a set of prescribed specifications (Bramwell 2003). In short, the buyer purchases the result of the product used (utilisation of service or performance outcomes) and not ownership of the product. Interestingly, the customer no longer directly manages or possibly even owns resources such as the inventory of spares. It has been argued that under these circumstances, and in the long term, suppliers may find it in their interest to invest in designing more reliable products and more efficient repair and logistics capabilities to increase profitability (Martin 2003). This implies that contracting on outcomes has an ability to elicit desired behaviours arising from the incentives within the contract, thus reducing the cost of MRO over the longer term for the customer.

Overall, there is more equitably aligned risks and incentives between suppliers and customers in outcome-based contracting than in traditional contracting (Kim et al. 2007). As such, we are beginning to find more B2B services contracts moving towards outcome-based incentives with hopes of witnessing significant decreases in costs, significant increases in customer satisfaction and the reduction of financial audits . Yet, outcome-based contracting is not a new form of contracting. Literature shows that as early as the 1960s, US government bodies have begun initiating contracts to optimise public spending. In defence contracting, questions such as addressing "incentives to produce good performance" and "incentives apart from profits to induce innovation" were subjects of discussions (Marcus 1964) to ensure that the roles of the parties concerned in the governance of the service contracts for the public are jointly engaged. Outcome-based contracts are also widely used in other public services such as health services (Shen 2003) and transport services (Hensher and Stanley 2008). In health services, outcome-based contracts has been promoted by the US Institute of Medicine (IOM) as a cost-effective mechanism to manage and ensure the "effectiveness of public medical services'' through funding of certain treatment outcomes. They use outcome-based contracts with local health centres to monitor and evaluate their performance in order to

‘‘redirect funds, away from less efficient programs within the communities towards programs which have proven themselves. Similarly in transportation services, Hesher and Stanley (2008) argue that outcome-based contracts are excellent mechanisms aimed at promoting economic effectiveness and efficiency through the life of the contract.

For MRO services, there is evidence to suggest that increasing number of contracts are moving towards outcome-based type of incentives to ensure effectiveness and efficiency of both the firms’ and the customers’ resources (Bramwell 2003). Despite this growing interest in OBC from both the public and private sectors in terms of application, little research has been established in understanding the dynamic relationship between the firm and the customer under an outcome contract where value is co-produced and created.

Although there have been several reports on outcome-based contracts (Gruneberg et al. 2007), there are not many studies that examine fundamental theoretical issues arising from the delivery of an outcome-based contract. In this study, we use a systems approach to analyse the delivery of two such contracts so as to highlight the theoretical issues contained within.

Context and Methodology

In this study, we analysed two defence contracts between two defence contractors and the UK government (in this case the Ministry of Defence or MoD) which were based on a type of service contract that delivers the outcome of *availability* of two types of equipment; a fighter jet and a missile system.

The two contracts analysed were awarded to 2 different organisations. Both were awarded for the maintenance, repair and overhaul of the equipment ‘through life’ i.e. for the whole operable life of the equipment till its out-of-service date. However, unlike the conventional MRO service contracts where the firms are paid on the basis of activities, repairs or spare parts used, the contracts were awarded on the basis of the *availability* of the equipment. This means that *regardless of how and where the equipment is used by the customer* (deriving value in use), the firm is obliged to deliver a set number of flying hours on the fighter jet and a fix percentage availability over a certain period of time (e.g. 95% availability) for the missile system. Clearly there are huge implications when contracting on outcomes such as availability. First, from the co-creation perspective, the usage of the equipment can now have an impact on the way the firm delivers the outcome. For example, military equipment by its very nature is used in high stress circumstances and can easily be damaged which has an impact on the availability of the jet (or missile). Second, while the MRO service is outsourced, the MoD had a big role in the partnership which is to provide Government Furnished Materials (GFX) including supplying physical facilities, material, data, IT and manpower to facilitate the company in achieving its outcomes. Thus the firm and the customer are co-located to deliver the outcomes, which is often the case for outsourced service contracts.

The delivery of these contracts serves as an exemplar for complex service systems where both parties are focused on achieving outcomes e.g.. the flying hour bank of the fastjet; the value is co-produced with the customer (to achieve the outcomes); and the customer

co-creates value with the firm through the *use* of the flying hours of the fighter jet and availability of the missile system. These service contracts were operating under complex relationships with clients and service providers and therefore relied heavily on both operand (tangible equipment) and operant resources (intangibles such as knowledge and experiences) to deliver the outcome of the contract. As the service system grows into the maturing phase, the service systems become more complex. As a result, standardization, automation, and commoditization were needed to ensure some efficiency.

We use a qualitative method to derive insights into the service delivery of the contracts. Qualitative research is often characterized by the use of multiple methods, which is often referred to as triangulation. There are a number of different methods to be used in qualitative research such as observation, analysis of texts and documents, interviews, and recording and transcribing (Dooley 2001). The logic behind using multiple methods is to secure an in-depth understanding of the phenomenon in question. In our study, we employed all four methods to extract data for the purpose of understanding the dynamics arising from outcome-based contracts.

We conducted 32 in-depth interviews with stakeholders from the firm and the customer. These interviews were audio recorded and subsequently transcribed, coded and categorised. Participant observation on the MRO sites was also employed to document the interactions between customer and firm.

We then analysed our findings from a "systems thinking" perspective and show evidence of the need for systems thinking in service research.

Findings and Analysis

Four key findings on Value Co-Creation within Outcome-based Contracts

Based on the challenges that surfaced, we categorised our findings as four aspects of value co-creation under the outcome-based contracts. These categories are: the understanding of value-in-use, service behaviours and service skills, capacity in service value proposition and value co-creation & co-production. For each of these findings, we exemplify that outcome-based contracts are drivers for service- dominant logic under complex service systems.

Understanding value-in-use

In the data, we found that there is a need to understand value-in-use (i.e. multi-state benefits). This is crucial because of the way value-in-use impacts on customer satisfaction, costs and delivery of the service and our data showed numerous examples of these types of "usage-change". For example, a pilot that is more careful about the use of the equipment such as "taking care when removing the communication plug" instead of carelessly and unknowingly flinging it, and hitting the windscreen (resulting in chipping glass) can save the firm £18,000 per piece of glass. Similarly, there is evidence in the data to suggest that when "rudders" are broken, they are simply "thrown into the sand and lost in the desert forever" rather than brought back to base. As one participant observed; "the rudder could probably be repaired for £1,000 rather than buying a new one for

£22,000". In both cases, the costs savings translate to benefits for both parties. We also found that an understanding of usage has an impact on how the service is being delivered. Due to the state-contingent nature of value-in-use (Ng, 2007), the usage of equipment would vary, as would the service delivered to ensure the most effective usage would vary as well. For example, it was noted that pilots were using "cables as a foot rest". Rather than moving the cable away, it was reported that the firm "put a guard over it and sort it that way", hence ensuring that understanding the usage of the customer resulted in better service delivery and ultimately leading to higher customer satisfaction.

Under this orientation, a systems approach can provide insights that underpin an understanding of value co-creation. In essence, if the firm and customer systems are not designed to provide value-in-use for both the firm's and the customer's role in co-creating value and the benefits are not made explicitly clear, both parties may not realise the conflicts that may occur due to different people delivering to different perceived value. Additionally, there is the additional possibility that the service design of the firm's system for the repair of equipment may conflict with the service design of the customer's system. The alternative is to consider these two systems as one combined superordinate system (Vargo and Lusch (2008) which will deliver the service to enable the customer to realise the benefits. In effect, the synergy that is created from designing the system as one whole (rather than two parts) creates an emergent property 'service' that would not be achievable when designing two separate systems.

Service Behaviours and Skills

In our second key finding, the study finds that the firm does not sufficiently emphasise the role of people in delivering value (service behaviours & service skills or embedded human capability). There is a high dependency on processes and activities that are equipment focused, without much attention on the behaviours required to deliver value. However, in complex service systems such as in MRO contracts, service delivery has high fixed costs that have a major human component. This indicates that the capacity and capability of human resources (operant resources) are paramount in service delivery and a lack of focus on human resources may result in lower or inconsistent service quality and an increased supervision cost due to higher transaction, monitoring, scrutiny and mistakes. A fully informed view capturing all information (including behavioural information) is necessary. For example, in our data, an employee of the firm noted that "if you've had a supplier that's going to deliver something to your house you wouldn't disown the responsibility of managing that supplier to make sure that he delivers what you need". However, if we "sit back and do nothing and don't get involved with the customer, they will just carry on the way and not deliver any of it because at the moment, they probably haven't got their head around that they (the customer) are also a key supplier".

Furthermore, our data suggests that there are skills involved in coordinating people, changing or leading different situations, developing relationships, learning to think as a team, reducing distortions and misinformation, establishing trust and projecting a good image of the company. Many of these skills seem to be attributed to individuals and personalities and while individuals will always be important, they would need systematic

support within the design of such a complex service systems so that the service delivered could be better replicated. As noted by an employee of the firm; “it’s no good waiting for things to go wrong before we do something about it, we’ve got to be knowing, we’ve got to know what’s going on all the time so that we can be ahead of the game in making sure that the user’s always got, availability to do the job that he needs to do and we have readiness and availability criteria set out in the contract which are very clear about what we need to achieve”.

This observation implies that efforts to instil suitable attitudes and behaviours arise from outcome-based contracts and this accentuates the service dominant logic. A shift towards a platform to include operant resources such as the coordination of personnel, reduction of misinformation and learning to think as a team between the firm and customer, ensures that service delivery is as efficient and as effective. This thinking resonates with the systems theory that stresses a “socio-technical” perspective as organisations are effectively made up of a combination of human and technology in a socio-technical system. Emphasis has to be placed on a general conclusion that the social and psychological aspects of work needs to be understood in the context of the task and the way in which “the technological system as a whole behaves”.

Capacity in service value proposition

Our third finding suggests that under complex service systems, the firm needs to have a clear understanding of where and how value is created within the service contracts and the contribution of components and resources to value (i.e. service capacity). There needs to be equitable focus on both equipment capability as well as embedded human capability in understanding the capacity for delivering the service. For instance, the firm has a fixed set of resources, both tangible (i.e. equipment) and intangible (i.e. people, know-how) to deliver on its service offerings to the customer. If the firm is to design and structure its capacity to deliver the service, the firm would have to understand which component of its costs deliver how much of value to the customer and the degree of importance of all resources within that system. In other words, there needs to be equitable focus on both equipment capability as well as embedded human capability in understanding the capacity for delivering the service. Hence, the service capacity of the contract becomes important to the firm.

For example, from the interview, there was an observation that revealed the firm was unable to “carry out the inspection and repair because there are various loopholes in military documentation or military procedures that don’t allow them to actually carry out the inspection or repair, there’s anomalies within the military system that people don’t understand”. These comments suggests that it is important to understand the resources and components of human and equipment capability as well as the links between resources, costs and service attributes to employ the optimal service capacity in delivering the service under the contract.

Under these circumstances, systems thinking considers both operand and operant resources. From equipment to human capability and from both actors within the firm and the customer, it is critical to understand how service capacity impacts upon the service

delivery, particularly under a complex service environment such as maintenance, repair and overhaul services. This relationship is non-linear, with complex feedback loops, time delays and amplifications. We therefore consider service capacity as a dynamic concept, dependant upon the specific demands of the moment. The analysis of such systems is best conducted through systems dynamic modelling which considers how these complex relationships may be modelled to provide systemic interventions that are often non-intuitive and which lead to step changes in systems performance.

Value co-creation and co-production
Last, our study finds that the firm is focused on its value proposition and less focused on the co-produced value. This is to be expected as traditional contracting allows the firm to concentrate *only* on its value proposition to the customer. However, outcome-based contracts as illustrated earlier, are contracted on the basis of outcomes. Contracting for outcomes demands that the firm fulfils its obligation to deliver at a level where the customer is partly responsible for the service delivery. Hence, the customer's value proposition in the value co-production of the contracts becomes the responsibility of the firm.

Interestingly, our study showed that the customer's responsibility to deliver certain aspects of the contract gave the firm an excuse to abdicate some of its responsibilities in value co-production. Yet, that does not change the fact that the firm has chosen to contract on outcomes, and with that choice comes the responsibility of understanding their customer's value proposition, (i.e. its systems, processes, structures, behaviours and design) to co-produce value. As such, there is a need for both the firm's and the customer's value proposition to be understood well by the firm in order to deliver the outcomes under the contract.

The interview data highlights that where demands of the customers are unreasonable, they are sometimes met with the objectives of building relationships whereas less unreasonable demands are tolerated as a one-off exercise. This then implies that under an outcome-based contracting environment, the firm is required to reflect on the service-dominant logic notion that "the enterprise cannot deliver value, but only offer value propositions". Without understanding what is required to optimise resources thorough the understanding of both the firm's and the customer's proposition to deliver better service at a lower system cost, may result in higher system costs due to transaction costs and misalignment issues such as seen from the data (i.e. completing work that is not within the contract, "scope creep").

In the next section, we analyse our data using a systems thinking lens.

Discussion

Systems Issues
In considering the case study from a systems perspective, the central insight is to consider the issue of boundaries. In the case of the traditional MRO contracting, the customer was essentially outside the system boundary and the interaction between supplier and

customer was at ‘arms length’. The analogy is one of a ‘port’ where the points of interaction are limited and governed by well established methods and procedures. The customer requisitioned parts and the more predictable this became the better the firm was able to manage their own delivery. This in turn provided predictability down through their supply chain and as a whole the supply chain gained resource efficiencies. This is the essence of a value chain with linear linkages at each dyad. Conversely, in an outcome-based contract, the customer and suppliers come *inside* the systems boundary in a much more complex arrangement that is non-linear and highly dynamic. The analogy is one of osmosis where there are many points where information passes between the systems. This change may be considered as movement from a relatively closed to an open system and has a number of quite considerable implications.

In traditional contracting, the firm seeks to close the system or ‘seal off the technical core’ (Thompson 1967). This means limiting the effect of variety on service delivery. Frei summarises these as in variety that emerges from customer inputs arriving at different times, wanting different things with different customers having different capabilities and willing to provide different levels of effort. The outcome of all this is that different customers having different opinions about the success of the service (Frei 2006). According to the law of requisite variety this variety must be matched or the firm becomes unviable. To do this in the traditional contracting model firms limit or attenuate the variety offered to the customer through pre-planned repair activities which are completely carried out by the firm *for* the customer. This transactional model is replaced in a outcome-based context where the customer and firm are working closely to introduce variety through changing usage thus the past is not a good predictor of the future. This introduces variety into the system by the customer demanding different things at different times and having different capabilities and levels of effort. The system has therefore moved along the continuum from being relatively closed to open and the typical operations management optimisation techniques are much less applicable. Indeed some would go further and argue that in this highly dynamic environment the problems are not amenable to reduction and new thinking needs to be applied (Weinberg 2001).

With the customer inside the system, both the firm and the customer have much less predictability. This manifests itself in higher supervision as both firm and customer seek to maintain control. Yet through Ashby’s law and Beer’s Viable Systems analysis we know that this substantially increased variety will *overwhelm* the supervisory levels of management, for as Beer argues the variety of the environment greatly exceeds the ability of managements ability to cope. Each different situation will require a different procedure to be designed, written and promulgated and eventually the costs and delay introduced will prohibit innovation. The solution is to either limit the variety (essentially at the contract stage) or to cope with the variety by devolving the variety matching to the lower levels of the organisation, in practice to allow individuals considerable more autonomy. This is a service transformation from traditional contracting with predictability and cost control to a new service model which emphasises flexibility and responsiveness as a complex adaptive system.

This in turn has implications for the original contract terms and employability. In the new open system, the second order activity, learning, is paramount. The quicker and better front line employees are able to adapt the greater will be the gains. But this has significant implications for recruitment. Finding experienced staff who can make judgements on the appropriateness of solutions is more expensive both in terms of recruitment and future development and in their direct labour costs. These higher labour and development costs need to be reflected in the contract for they represent the systems ability to adapt to the realities of the open system.

This transformation from closed to open is reflected in the case. There is a direct comparison between those teams where parties are entrenched in their 'them and us' mentality and those teams that achieve the gains of 'cheaper and quicker' that come from working synergistically. This brings us to further insights provided by the systems property of emergence. At the core of emergence lies the quote often attributed to Aristotle that 'the whole is greater than the sum of its parts'. Where the firm and the customer work closely together there is much to be gained for *both* parties over the alternative situation where each party seeks to maximise their own returns and overall gains are diminished.

This has considerable implications for socio-technical systems design. The focus of the traditional contracting model is that of a closed system. Limited variety allows for predictability which allow for detailed processes and procedures to be developed. This leads to the applicability of specialised equipment and tightly defined job roles, and many of the features of rigid processes (Wemmerlov and Hyer 1989). Open systems on the other hand are unpredictable. Equipment needs to be more flexible, staff need to be adaptable and procedures are harder to specify as circumstances are changing and they quickly become irrelevant. The emphasis becomes less on rigidity and more on fluidity (, Wemmerlow, Ponsignon) with the attendant increased emphasis on technical skills, increased task variety and individual discretion.

The combination of the movement along the continuum from closed to open systems with its attendant higher variety leads to a socio-technical systems design that emphasises adaptability in people and equipment. Understanding, this new type of system requires different ways of thinking. Closed systems are amenable to the methods of reduction and deterministic models. Open systems require dynamic models that represent the complex interdependencies, time delays and non-linearities to be found in these more dynamic environments. The models that we develop should focus less on optimisation of individual parts and more on understanding the 'systemic' limitations to improved performance for the whole system. This transformation of thinking will provide unique insights into problems that should both improve practice and inform theory development.

Conclusion

Outcome based contracts are an excellent example of organisations moving from Goods-Dominant logic to Service-Dominant logic. However as these two cases show, they also provide an excellent example of the challenges in moving from the two logics. In outcome based contracting both parties need to come together to achieve an *effective*

value co-creation/co-production model (rather than the individually efficient models that prevail in G-D logic) and in turn, they also need to develop the appropriate contractual mechanisms to achieve consistently high benefits that are financially viable. In addition, *inefficiencies* could arise from a combination of two local optimums rather than optimising globally across two systems. This then results in an increase in overall system costs which would make the contract relatively more expensive. *Ineffectiveness* could arise from the combination of two local optimums as well as from both parties' inability to explicitly build a combined system. And as both parties focus on their individual system efficiencies, the transaction cost increases from the interactions. In other words, as both parties build more efficient individual systems, the overall effectiveness of the contract may suffer (due to more altercations and transactions), leading to sub-optimal outcomes[i].

A systems view would allow both parties to recognise the emergent property 'service' that emerges from the design of one service system rather than two separated firm and customer systems. However, the drawbacks from such an approach are that the system moves from being relatively 'closed' with the customer input being exogenous to the firm system to an open system where the variety of the inputs has the potential to overwhelm the service design of the firm (Ashby 1958). The solution is provided by Beer (1984) who argues for devolving the control of the system to the lowest levels in his viable systems model. Only by doing so can the systems remain viable over time. In turn this has implications for socio-technical systems design that recognises the importance of the interplay of behaviours and procedures in a systems design. Finally, we also recognise the importance of understanding capacity to deliver. This too is a complex dynamic which is affected by the feedbacks and non-linearity of an open system and which suggest is best understood through the methods of systems dynamics rather than the deterministic models of closed systems.

In short, this paper has suggested that the study of service science is best addressed through a systems approach. We have used outcome based contracting as an example of the S-D logic that underpins service science and considered that from a systems perspective. Many insights have emerged that suggest that service systems are a complex interplay between firm and customer that form an open system which needs to be designed using the techniques of Viable systems and systems dynamics.

Table 1: High Level Systems Concepts

High Level Systems Concept	Author(s)
1. Open and Closed systems The notion of an open system is associated with the early work of the Biologist and General Systems Thinker Von Bertalanffy. He describes open systems as a system which has an "*exchange of matter with the environment*",. Closed systems, on the other hand, are systems where *no material enters of leaves it* and are typically found in the realm of physics and physical chemistry. The discussion on whether a system is open or closed has particular application in the management of service systems. Consider the implications of taking a closed or relatively closed system view of an organisation or department in an organisation. Such a system would be deterministic and optimisable. However, taking an open systems view would suggest a complex and dynamic interaction of the organisation and its environment with undeterminable results. The consequences of closing the system in a technical core are at the centre of the design considerations associated with front office, back office debate developed by Chase (1978).	Von Bertalanffy 1971
2. Socio-Technical Systems A major part of the systems movement that was based around the view of an organisation as an open system was the socio-technical systems school developed during the 1960s at London's Tavistock Institute. Emery and Trist (1960) in their famous work on socio-technical systems were interested in the open systems notions of input-throughput-output and how a system maintained a quasi-stationary equilibrium despite changes in the environment. The Socio-Technical school drew a general conclusion that the social and psychological aspects of work needed to be understood in the context of the task and the way in which "the technological system as a whole behaves". The technology system here is taken to include not only the hardware, machines etc but the methods and procedures of work and how that work is organised in a process. Thus the Tavistock research identified the technology component of the system as playing an important part in the organisation of the system and that it was no longer possible to talk of a purely social systems composed of people and their relationships but to consider the enterprise as a combination of human and technology in a socio-technical system.	Emery and Trist (1960
3. Law of Requisite Variety How a system behaves is a key question for those systems	Ashby (1958)

researchers working within the general field of cybernetics. One of the most important ideas for service systems research is Ashby's law of requisite variety. The law states that at a minimum there needs to be as much variety in the responses available to the regulator (manager) as in the disturbances that emerge from the environment. If there is not then the manager cannot guarantee acceptable outcomes and therefore keep the system viable. Ashby summarises the law as *only variety can destroy variety.*	
4. Viable Systems Model Beer (1984) applied Ashby's law of requisite in his Viable Systems Model (VSM) where the term viable is used to assess whether an organisation is able to survive in its environment. The paramount viable system in an organisation (VSM has 5 sub-systems) is its *producer system,* which is the system which generates the income on which the organisation depends for its survival. Producer systems are threatened with overwhelming variety from the environment and have two potential options which Beer terms variety engineering. 1. Attenuation; limiting the amount of variety on offer eg a fast food restaurant like MacDonald's has a very limited range of offerings on its menu. If what customers want is something outside the fixed menu then the attenuator (the systems designer) has reduced operations response below the threshold and the producer system does not have sufficient variety to respond. 2. Amplification; for example in a producer systems that only offers one choice of colour, for example black, we could amplify variety by offering the customer price promotions that emphasise the value in buying black or we could develop an advertising strategy that promotes black as "cool".	Beer (1984)
5. Systems Dynamics Systems dynamics began with the work of J Forrester (1956) with his work seminal paper in the Harvard Business Review and subsequent book on industrial dynamics. Forrester was a systems thinker whose focus was on the **dynamic** relationships between entities Industrial dynamics is concerned with time varying behaviour in organisations. The primary focus is on how feedback loops, non-linear relationships and time delays have a major affect on organisational performance.	Forrester (1956)

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[i] As an anecdotal example, here is a comment from an RAF respondent who was in the midst of implementing 'lean' processes within the RAF/MoD.

> "*same time we brought in lean processes and moves towards pulse production. Now that would have caused us a challenge even if we had been doing it just as an RAF organisation because it is a fundamental mind change in terms of how you approach maintenance err so that was always going to give us*

difficulties, however we did it. One of the problems we've had is that by doing the two simultaneously where people have had problems implementing the lean changes it's been too easy for them to go that's [THE COMPANY]'s fault because we've partnered with the company because we are now working for a civilian organisation and to confuse the issues we would have had changing to lean and pulse production with the issues and problems we would inevitably have changing our mindset to work with a civilian organisation erm so that's caused challenges".