Value co-creation in Complex Engineering Service Systems: Conceptual Foundations

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Abstract

This paper discusses the delivery of value in complex engineering service systems. Through a review of the philosophical, axiological and economic foundations of value, this paper axiomatically proposes value to be a naturally occurring property, phenomenologically determined entirely by the perceiver(s) ‘in-use’ (i.e. in experience). In the investigation of how such a conceptualisation of value should be delivered, service management literature on the delivery of value is also reviewed. Based on these discussions the paper proposes five conceptual foundations for an integrated approach to value co-creation in complex engineering service systems; (1) A perfect system for the co-creation of use-value makes endogenous all co-creators use-value; (2) A service system of co-creating endogenous use-values must recognise the multiple states (context) of use (experience) which may not yield consistent beneficial outcome for the co-creator whose use value is contextual; (3) A system of co-creating endogenous use-values must take a systems approach; (4) Use value in contexts (customer variety) could be absorbed or attenuated by any of the co-creators of value and (5) a service system of co-creating use-values must acknowledge the transformative nature of co-creation on individuals resulting from the interactions within the system. In so doing, this paper contributes to foundational knowledge for the design and delivery of value propositions for co-creating use-value in service systems.
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Introduction

Coase’s (1937) *The Nature of the Firm* begins by stating that ‘Economic Theory has suffered in the past from the failure to state clearly its assumptions.’ Coase goes on to warn of the dangers of failing to examine the foundations upon which research and theory has been built and more importantly, the need to interrogate such theories with rival assumptions. Drawing inspiration from Coase, this paper examines the role of the firm in delivering value from first principles in the philosophy of value.

This paper introduces four lemmas deduced from the philosophical, axiological and economic foundations of value. We propose that value is not a naturally occurring property, it is dependent entirely on the perceiver(s) and it is phenomenologically determined (i.e. from conscious experience). It is also deduced that it is inherent of all firms to ensure its offering is valuable ‘in-use’ (i.e. in experience). These four lemmas have important consequences for the role of the firm in delivering value. As such, this paper looks to examine value delivery in complex engineering service systems, in which specific arrangements of equipment, people and technologies interact to provide a value proposition for customers.

However, due to the established paradigm that production of goods is the basis of wealth creation, much of the existing discussion and analysis on the delivery of service systems has been through the lens of goods based thinking, “because manufacturing has been the dominant economic force of the last century, most managers have been educated through experience and/or formal education to think about strategic management in product-oriented terms. Unfortunately, a large part of this experience is irrelevant to the management of many service businesses” (Thomas 1987). This raises the challenge for academics to question the assumptions upon which conclusions are being drawn and examine the theoretical basis supporting current approaches.

The paper proceeds as follows. In the first part, we discuss the philosophical foundations of value. Next, we show how the understanding of value has changed and evolved over the years with a discussion around use value and exchange value. The paper then moves on to examine the two separate streams of literature on service research around management and manufacturing, that of the tangible offering and that of the intangible offering. From these discussions, and based on the foundations of value, we conclude the paper by proposing five foundations for an integrated approach to value co-creation in complex engineering service systems; (1) A perfect system for the co-creation of use-value makes endogenous all co-creators use-value; (2) A service system of co-creating endogenous use-values must recognise the multiple states (context) of use (experience) which may not yield consistent beneficial outcome for the co-creator whose use value is contextual; (3) A system of co-creating endogenous use-values must take a systems approach; (4) Use value in contexts (customer variety) could be absorbed or attenuated by any of the co-creators of value and (5) a service system of co-creating use-values must acknowledge the transformative nature of co-creation on individuals resulting from the interactions within the system. In making these five proposals we contribute the first step towards a foundation for design and delivery of value propositions for co-creating use-value in service systems.

Philosophical Discussions of Value

Value has been subjected to much discussion and debate over the centuries. Despite a common etymological origin, the term has evolved into two distinct meanings. The first describes value as ‘goodness’ determined by an individual personally and culturally, and in an ethical sense. These such
values are held most dear by an individual and govern what the individual does and becomes (e.g. Weber, 1909). The second meaning, and the subject of this paper, also describes value as ‘goodness’ but in its description of something; be it a person, an idea, a product, an activity or anything else.

The study of the latter meaning of value as described above has a deep mathematical and philosophical history, rooted in the discipline of axiology. Axiology, the philosophical study of value, concerns itself with the analysis of value, its frameworks and the evaluation of what is ‘valuable’, or with the assignment of value to items, to properties or to states (Bengtsson, 2004).

It is no surprise that those who study value have been both immersed in mathematical logic as well as philosophy in the attempt to gain insights. Indeed, scholars have proposed that if value is to be a science, it must therefore rest on an explicit axiom, a proposition that is not proven but deemed to be either self-evident or foundationally sufficient towards building a logical system of enquiry upon it (Hartmann, 1967). In discussing value, Hartmann considers Moore (1943) as being close to some axiom of value when he suggests the nature of goodness (value) cannot be natural. In other words, if something is of essence or if the essence is constructed with an individual (depending on your philosophical standpoint), its goodness cannot be naturally occurring (Moore, 1943). Hence, a description of an object, an event or anything else can be only good if it is perceived to be good by an individual who realises it. ‘Goodness’ can therefore only be subjectively evaluated, even if it may have invariant properties of goodness shared with others. Such properties are deemed to lend ‘goodness’ to the object only because of the perceiver, and not because the properties in themselves are good. An ice-cream on a hot day is deemed ‘good’ because a perceiver attributes goodness to it, not because the ice-cream is naturally good. The firm lemma of value can therefore be stated as:

Lemma 1: Value is not a natural occurring property.

In The Republic (360 B.C.E), Plato proposes the notion of intrinsic and instrumental (extrinsic) value. In this proposition Plato suggest that items with instrumental value are good to have as it is instrumental to achieve or obtain something else that is good. Whereas, an item that is intrinsically of value is good to have for itself. Clearly the two are not mutually exclusive and it is not uncommon to have products exhibiting both intrinsic and extrinsic properties. Dewey (1939) argues that across all contexts, there are only extrinsic properties as intrinsic properties are relative to a situation or a context. Moreover, mathematical logic suggests that extrinsic value may exhibit some level of denumerable properties i.e. that value in this sense can be countable in some way (Hartmann, 1967). Intrinsic value, on the other hand, may not be denumerable, the notion of a brand status of a good, even if priced, could be as non-denumerable in value as complex numbers.

Scholars developing academic thought around value have suggested different ways of classifying extrinsic or intrinsic value, albeit with different degrees of robustness. Mattsson (1992), for example, suggests that intrinsic value is analogous to the emotional dimension of value, whilst extrinsic value could have practical and logical dimensions. Consequently, a chair has the practical value of a ‘seat’ and has logical value of ‘width, size or height’ but could also have some emotional value of being ‘great-grandpa’s chair’. Hartmann (1967) introduces a further concept of value – that of systemic value – where the characteristics of the thing that is good has finite properties defined by a system, or the norm. Thus, a chair is only good if it can seat a person without falling over, since all good chairs share the same property.

The idea of extrinsic value has also been developed by Marx (1867), where not only is the item purposeful, the value of it can only be realized in context. Marx described it as “value only in use, and is realized only in the process of consumption” (Marx 1867 (2001), p.88). Such discussions have one commonality in their descriptions. As proposed by Moore (1943) and Hartmann (1967) and as the above discussion implies, the commonality among discriptions is that value can only be determined and evaluated by the perceiver.

Lemma 2: Value depends entirely on the perceiver(s)
While intuitively logical, Hartmann (1967), Haglund (1988), Mattsson (1992) and other scholarly extensions of Hartmann’s (1973) work diminish the importance of the philosophical argument of value. Instead of seeing objects as having some properties emanating from them, Husserl (1905) proposed a phenomenological way of looking at objects by suggesting that individuals, in their own way re-constitute such objects such that the object ceases to be something simply ”external”, but become part of the individual’s group of perceptual purpose. Phenomenological value therefore regards objects as inherently conceived in the experience of it i.e. in the interaction or relationship between the item and the perceiver. Therefore, understanding phenomenological value is the understanding of how to identify the invariant characteristics of items and how such characteristics have a role in the way individuals perceive the reality. In so far as ‘great-grandpa’s chair’ is concerned, it can only be of value as experienced (mentally or physically) by the valuer within his/her consciousness (Husserl, 1939). Such a view of value differs from Hartmann’s in the sense that it is systems view of value. The value is emergent and experienced between object and subject, as compared to Hartmann’s reductionist view of value, where value lies within an object and subject. A reductionist view of value in objects and perceivers does not give sufficient weight to the interactions between them, interactions that would serve the individual’s contextual purpose.

This discussion of value is important as it resonates with scholars who have described value as contextual (Vargo and Lusch, 2004; 2008). Value is contextual because of both the nature of the thing itself in that context as well as the nature of the perceiver who perceives it. But most importantly, value is contextual because of the ‘flows’, or interactions between the thing itself and the perceiver occurring within that context. Such ‘flows’ in themselves are uniquely phenomenological. Whilst the first two lemmas describe the object of value, we argue for a third axiom to value to describe how it is determined, that is to say that goodness (value) is a conscious experience, emergent from interactions (of mental, physical or others) between subject and object. On this basis, we propose lemma 3:

Lemma 3: Value is phenomenologically determined (i.e. from conscious experience)

Lemma 3 is consistent with Vargo and Lusch (2004; 2008) who consider value to be phenomenologically determined, that it is “uniquely and contextually interpreted” (2008, p.4). In addition, literature in consumer culture theory has long since discussed the notion of consumption as experiential within a social and cultural phenomenon (Belk, 2007; Arnould and Thompson, 2005).

The above axiomatic lemmas of value are thought to reflect the concept of ‘use-value’ as opposed to that of exchange value. Use value, as suggested from the term, is value that is only determined ‘in-use’. While unfortunate in its term as it does not fully convey the richness of its meaning, we will nonetheless accept this for pragmatic use within the paper. However, we would add that, as the lemmas above have expanded, the notion of ‘use’ here could clearly be both emotional or phenomenological ‘use’ i.e. phenomenologically experienced value-in-use; could be temporal or atemporal, could be intrinsic or extrinsic, not naturally occurring and always as perceived by the perceiver in context. Conversely, exchange value, which underpins traditional customer-producer relationships, is characterized by an item’s worth in exchange, where each party exchanges one kind of value for another (Bagotzzi, 1975). A customer buying a TV would exchange money (of value to the firm) for the TV (of use value to the customer)

Our purpose of stating the three axioms of value is to facilitate a discussion of the role of the firm seeking to create a valued offering in a market. However, before we do this, we provide a historical account of value as used in markets.

Use Value and Exchange Value

The onset of the industrial era resulted in the focus of transforming use-value into exchange value. Such commodification in Marxist terms, not to be confused with commoditization (Rushkoff, 2005), is concerned with the conversion of something (an activity, an idea, an invention) that has use-value into economic value. A man with skills in cooking has use-value to himself and to his family but could use the same skills to become a chef, thus commodifying his skills into an exchange value,
where a customer could purchase such skills. Similarly, the use-value of the skills of engineers, workers and managers are consolidated within a firm to manufacture products with exchange value in the marketplace, spawning original ideas of early Marxian Economics of the labour theory of value. Over time, modern economics in dealing with technological advancements has shifted to a marginal utility approach to economics in the production of goods. These goods form the market system around which trade and commerce have thrived over the past two centuries and in so doing promote exchange value. The notion of producing goods with exchange value has therefore made manufacturing the stalwart of economic life since the start of the industrial era. Indeed, as early as 1776, Adam Smith proposed that the wealth of nations was built upon a countries ability to produce an excess quantity of goods and then export this excess to generate wealth. This provided the foundation for the dominant view of physical goods as the staple for wealth creation.

The link from exchange value of goods to the firm back towards use-value for the customer generally traverses the literature surrounding the theory of choice. This is because even while an individual may wish to have something, that individual often has to choose from a market of similar or substitutable offerings. To achieve use value for the customer and exchange value to the firm (often manifested in its price), a transaction has to occur. Such a transaction forms the market around which economics scholars have analysed in great depth. Units of analyses have focused on markets, individuals and firms with many models and insights into understanding individual rational, interactive and collective choice (Hargreaves, 1992) and psychology of choice behaviour (Glasser 1997; Maslow, 1998) for example markets of asymmetric information (e.g. Akerlof, 1970; Stiglitz, 1987) and exchange and governance in new institutional economics (Williamson, 2000; Alston, 2008). For mathematical tractability, the proxy for use-value was often ‘utility’, a concept often used within choice literature, a simplistic concept of relative satisfaction from the consumption of a good. The proxy took root and even while it spawned vast literature in economics, it also proliferated an entire stream of marketing research around customer satisfaction.

The notion of utility as a proxy for use-value has had a severe effect. It served to de-contextualize and de-individualize value as though a product had its own essence, often without reference to the perceive or the context. Theoretically, the object being thought of as ‘good’ on its own is a consequence of invariant properties of goodness bestowed upon by perceivers but if many perceivers perceived it as good, the object was implicitly assumed to be all good, and always good. Context and individual experience of value were marginalised under that assumption. This led to a goods centric focus where products were manufactured, the purpose then being to seek the target market, in essence, ‘seeking the market of perceivers who might perceive it as good within their context’. Marketing as a function became a servant to that task. The focus on choice, as the link between exchange value for the firm and use value of the customer, also served to skew the task of marketing further. Since use value is often privately experienced by the customer after the transaction, it held little interest to the firm (unless it informed loyalty or repeat purchase). The data surrounding use and experience, particularly of goods, was also scarce. Finally, as most paymasters of marketing are firms, the natural tendency was for marketing to serve exchange value, rather than use value. This meant that even though the definition of marketing was to better serve customers profitably, marketing focused less on its influence on the firm in terms of understanding decisions on production systems and manufacturing decisions than on the customer in terms of understanding their behaviours, consumption and choices.

Yet, the creation of value is often thought of as a fundamental cornerstone of the management discipline, for any firm (Albrecht, 1992; Alderson, 1957; Anderson & Narus, 1999; Doyle, 2000; Drucker, 1974; Woodruff, 1997). Moreover, it is often argued that it is the role of marketing to assist the firm in the creation of value for its customers, value that is superior to its competition (Tzokas & Saren, 1999: 53). Yet, within marketing and academic literature in general there is a lack of conceptual consensus on customer value, a manifestation of whether exchange value or use value should be the focus of analysis. Consequently, firms often do not know how to define value, or indeed how to measure it, much less deliver to it (Anderson & Narus, 1998). This is unsurprising, since most measurement of value assumes the value of the offering is acontextual and rather than understand the
heterogeneity of the customer in the experience of use-value, most studies seek to remove customer heterogeneity and context entirely from the investigation. As a result, divergent approaches and perspectives have resulted in fragmented streams of thought and research on what value is, how it is produced, delivered and consumed.

However, we would argue that for any offering, be it a good or an activity, to have any exchange value it must have some use value to some customers within some contexts. Thus, as also proposed by Ballantyne and Varey (2006), exchange value implicitly includes an estimate of use-value of any offering that has been contractually exchanged or promised for ‘use’. This would be the minimum requirement for a market to exist for the offering. Our final lemma proposes:

Lemma 4: It is inherent of all firms to ensure its offering is valuable ‘in-use’ (i.e. in experience)

Delivering Value: A Review

Organizations are often called upon to deliver superior customer value as a major source of competitive advantage (Payne and Holt, 2001; Eggert, Ulaga, & Schultz, 2006; Liu, Leach, & Bernhardt, 2005; Ulaga & Eggert, 2006). In a similar vane, the delivery of value and a customer orientation is echoed amongst academics in many different fields (Cannon and Homburg, 2001; Chase, 1978; Amit and Zott, 2001; Ramirez, 1999; Kim and Mauborgne, 1999). Indeed, Ravald and Gronroos (1996) claim that a firm’s ability to provide superior value is regarded as one of the most successful competitive strategies in the nineties. Within the B2B literature, delivering superior customer value is associated with assisting firms in developing and maintaining strategic buyer-seller relationships (Liu, Leach, & Bernhardt, 2005), resulting in loyalty (Bolton and Drew, 1991) and the potential to grow margins and profits (Butz and Goodstein, 1996). From the practitioner’s domain, Drucker (1993) proposed that what value means to the customer is one of the most important questions a business should ask. Thus, practitioners and academics alike have stressed the importance of delivering customer value as the key to success.

Service in Tangible Offerings. With value often deemed as exchange value, and with use-value implicitly assumed within customer utilities, a goods-centric legacy from the industrial era has heralded processes, systems and knowledge as core assets for the production of tangible goods. Yet, as manufacturing became more complex and as competition heightened, firms felt the pressure to ‘add value’, predominantly through the provision of other activities. This idea of ‘adding value’ generally means that the addition of services could allow the firm to derive higher exchange value (from price). From the B2B front, research has shown that manufacturers provide such ‘added value’ services in the form of training, integration with clients’ capabilities, consultancy and other services related to the provision of equipment (Ren, 2009). Indeed, for many manufacturers to remain viable, research has shown that added value through services is essential (Neely, 2008). This provision has been commonly referred to as the servitization of manufacturing. Servitization has been discussed widely, frequently through an examination of the move by manufacturers to generate greater returns by providing through life support for their products (Vandermerwe & Rada, 1988; Matthyssens & Vandembempt, 1998; Anderson & Narus, 1995). The hazards and enablers to the process of servitization have also been studied (Oliva & Kallenborg 2003, Mills et al. 2008). Furthermore, servitisation has resulted in research into the combinations of offerings that generate a higher exchange value from both products and services in bundled packages. These combinations of products and services are often referred to as Product Service Systems [PSS].

As research into PSS progresses, it is clear that the so-called ‘added-value’ to exchange value is beginning to converge into use value. Baines et al (2008) define PSS such that it embodies “an integrated product and service offering that delivers value-in-use”. However, due to the established paradigm that production of goods is the basis of wealth creation, much of the discussion and analysis of engineering or equipment service has been through the lens of goods based thinking. This raises the challenge for academics to question the assumptions upon which conclusions are being drawn. As manufacturers add ‘service’ to the body of product-centric knowledge, the tendency is to treat such
activities as an extension of the body of knowledge in manufacturing and engineering. From the perspective of use-value, this is theoretically problematic for 3 reasons.

First, for a good to be of use value it must be integrated into the customer’s system so that the value could be phenomenologically experienced (lemma 3). In view of this, if a firm truly hopes to achieve the delivery of use-value, it must acknowledge that its traditional ‘production processes’ are not linear and occur in an interactive and iterative manner with outcomes that emerge from such interactions. A goods-centric legacy of linear production processes towards some tangible end may not hold for use-value that is amorphously ‘delivered’ through a multitude of interactions with the customer.

Second, a good that is phenomenologically experienced by the customer is often realised away from the firm that manufactured it. Thus, in achieving use-value, the firm is tasked to include the customer’s perception and capability (lemma 2) to experience the good as part of the firm’s responsibility, so that a customer’s beneficial outcomes could be attained, the notion of goodness as a non-naturally occurring property (lemma 1). In contrast, a goods-centric mindset with boundaries of where ‘production’ ends may imply that the firm is only responsible for the delivery of ‘service activities’ which they undertake when faced with their customer.

Third, the achievement of excellent outcomes is realised from an experience within the customer space, constituted from both the good and its activities. This is as opposed to a customer merely having a ‘good’ product, through the contribution of resources by both the firm and the customer (Prahalad and Ramaswamy, 2000). Traditional manufacturing systems, processes and knowledge frequently exclude customer resources in delivering a manufactured good and for good reason, since the introduction of a customer may force the firm to absorb too much variety and become non-viable. Yet, this approach may need to be adapted, given that the access to and integration with a customer’s systems, processes and knowledge are necessary for the delivery of a satisfactory outcome.

Service in Intangible Offerings. Concurrently, the management stream of literature has had a long history in service research (Huang et al., 2009). Early work in this area focussed upon goods as tangible objects and services as intangible and a form of ‘performance’ (Say, 1803; Senior, 1863). In accordance, production and consumption is conceptualised as separate for goods, but potentially instantaneous for service. The intangibility and indeed the interaction between producer and consumer form two of the key building blocks for the IHIP service definition [intangible, heterogeneous, inseparable and perishable] which has been both endorsed and challenged by management research (Lovelock and Gummesson, 2004; Keh and Pang, 2010). Much of the research in this area is limited in focus, concentrating on service contexts that are inherently more intangible in nature, such as hospitality, tourism, banking or telecommunication. More recently, scholars within this stream of research have attempted to move the discussion of value back to use value (see Vargo and Lusch, 2004, 2008; Schneider and Bowen, 1995). This is almost certainly because, unlike the purchase of a tangible offering (e.g. a TV), intangible activities which act on the individual and his/her possessions make the experiential value of an offering (traditionally labelled as ‘service’) more visible to the firm. Managers and service researchers have often described the "moment of truth" as the defining period when the interaction between the firm and buyer is of crucial importance to determine customer satisfaction (Bitner, Booms and Tetreault, 1990; Churchill & Surprenant, 1982; Anderson & Sullivan, 1993). In management research then, the gap between use value and exchange value is narrowed since the value of the intangible offerings such as hotel, banking etc. is often experienced with full visibility and involvement of the customer and the firm during a service encounter as opposed to the private experience of a customer with a manufactured good. It is therefore not surprising that use-value became more prominently attended to within management research studying intangible offerings as opposed to manufacturing research studying tangible offerings.

Within service management research the service encounter embodied use-value, which is now more widely viewed as jointly co-created between the customer and the firm for mutual benefits (Payne, Kaj, & Pennie, 2008; Prahalad & Ramaswamy, 2003). However, management researchers have not sufficiently engaged with the implications of service when delivered in combination with goods. Even where a tangible good is involved, the good is often treated as a component of the service with
researchers describing service provision on a continuum of tangibility-intangibility (e.g. Shostack, 1977). In a similar approach to the way manufacturing researchers treat activities (services) as an extension of manufactured goods, service management researchers often treat tangible goods as a part of service activity. Such a point of view is also theoretically problematic because the realisation of the good by a customer may require resources accessible by the customer within a context. Thus, equipment design and manufacture has to consider what is appropriate to meet the context of the customer and the cost of provision, whilst at the same time considering the skills of the customer to realise use-value. From a use-value perspective, equipment within a service environment is not unchangeable, and is designed for ease of use and appropriate operability. Thus when customers use equipment or goods that includes service activity provision it is essential that the combined offering that is delivered is integrated effectively to best serve use value in context, as well as being cost efficient for the firm. This means that the equipment could be re-engineered and re-designed to facilitate service activities provision, just as human practices, processes and activities could be redesigned to suit equipment for better outcomes.

Manufacturing and engineering service research and management research into service stayed within their own research domain for some years, that was until Vargo and Lusch (2004, 2008) through the service-dominant logic, proposed that in effect, all offerings are services, whether the firm’s value proposition was a good (a distribution mechanism for service provision) or activities (direct service provision). SDLogic also proposed that value co-creation is a phenomenological experience of the beneficiary, whether it was experienced with firm-produced-goods or firm-delivered-activities. From an SDLogic perspective, the notion of ‘delivering’ value has therefore evolved into a more mature understanding. In this notion organisations can only deliver value propositions, be they direct or indirect propositions, use value can only be co-created and phenomenologically experienced, and exchange value derives from some use-value that the customer expects to be co-created between himself/herself and the firm’s value propositions.

Given this notion, the concept of value co-creation can be seen as the meta concept that extends previous service research in operations and strategy, which traditionally emphasized the role of the customer within a service system such as the customer contact model (Chase & Apte, 2007; Chase & Tansik, 1983), customer interactions (Johnson, Manyika, & Yee, 2005) and co-production with the customer (Ramirez, 1999).

Even though SDLogic has been an integrating approach, the meeting of minds between the two streams of research has been slow. This is disappointing as value co-creation taken as a meta concept holds potential competitive advantage if it is fully understood by the firm.

To use the lexicon of SDLogic, where direct service provisions are tied to indirect service provision (equipment) such as in the case of complex engineering equipment in healthcare (MRI) or defence (fastjets), the understanding of use and outcomes required by the customer over time could allow the organisation to change direct and indirect service provisions, business models, charging for use or outcomes (e.g. power by the hour © by Rolls Royce) instead of equipment ownership. By not separating equipment from activities and instead, focusing on benefits and the value offering in totality, firms could also innovate for better outcomes and achieve efficiency gains from redesigned and re-engineered equipment that enable better or different direct service activities. Yet, such a system of provisioning must recognise that indirect service provision has its own knowledge set and challenges in re-engineering and re-design compared to direct service provision and a lack of understanding could result in the failure to integrate important elements with impact on use-value that could be phenomenologically experienced both directly and indirectly. The success of the iPhone can be attributed to a phenomenological experience of use value in many contexts (enabling multiple context of use for the customer) and yet with the ‘indirect service provision’ (iPhone) constantly changing its technology through increasing number of apps to facilitate the individual’s life activities across contexts. There is still great scope in both manufacturing and service fronts for exploring interactions between direct and indirect services in co-creating experience (Pine and Gilmore, 1998) in line with service dominant logic.
From the discussion above, and based on the three lemmas, we now provide some propositions as foundations for an integrated approach to value co-creation in complex engineering service systems.

**Co-Creating a Valued Offering in a Service System**

Use Value as Endogenous. Our discussion above leads us to a conclusion of logic that is that historically, use value has been treated as exogenous to a firms delivery and manufacturing systems (due to predetermined customer specification); just as the tangible offering was also exogenous to customer use and experiential system. We will explain this in greater detail.

Manufacturing and engineering systems produce goods to a set specification. Such a specification is determined in many ways, often through feedback from customers, needs analysis and customer or market research. However, once the specification is obtained, goods and equipment are manufactured in the most cost efficient manner. For more complex equipment, the determination of such a specification sits within requirement engineering. Requirement analysis involves activities that determine the needs or conditions to meet new products, taking account conflicting requirements or user specifications. Theoretically, such a process immediately positions value (use or otherwise) as exogenous to delivery i.e. the system delivers to a pre-determined set of specification which implicitly specifies also the context of use. At the point of use/experience, the good has been produced, so the customer has to tailor his/her own system around the good which may not be ideal across all contexts. If use value is endogenous, for instance, if the firm is tasked to deliver customer outcomes across all possible contexts, customers do not predetermine states and both the firm and the customer may wish to consider all contexts of use and every use context as probabilistic. Of course, the probabilistic nature of contexts would have an influence on design and which aspect of the offering is flexible enough to still achieve use value across contexts. The nature of customer inputs and the need to attend to contextual variety of use could also become a joint activity with different set of processes linking the firm and the customer to attend to different contexts. The task for both the firm and the customer is to optimise the configuration of resources – both tangible and intangible towards, achieving use value across all contexts, for all entities in the system.

What then is the use-value for the firm in this co-created system? The firm's use-value derived from co-creating use-value for the customer is clearly revenue i.e. money. Money as use value for the firm, is obviously 'good', (one could argue that applies even in the phenomenological experiential sense) and is of use-value across all contexts. Logically therefore, context of use-value from revenues, from the firm's perspective, becomes irrelevant.

**Proposition 1:** A perfect system for the co-creation of use-value makes endogenous all co-creators use-values.

Use-Value as Contextually Co-Created. Clearly, systems for value co-creation are not perfect. The firm cannot design and deliver a value proposition that works across all contexts of use. The amount of variety that would need to be absorbed in order to deliver customer use-values across all possible contexts would cripple the firm. As an illustration, to consider value as exogenous to the system would not matter if the experience of the good rests in a single state. If one needed a cup that would be used the same way every day, in the same location, under the same context (although one can argue the individual would never be in the same context), a predetermined specification of a cup based on one contextual state of use would not be difficult. If, however, the experience of the cup changes with varying states (contexts), e.g. the cup is now to be used in the garden where there may be dust and bugs, the firm has now to decide if a further need (a lid) might be built into the specification. This immediately leads into the debate on whether that additional specification might conflict with the original specification (my cup indoors doesn’t need a lid) or if there is more revenue (greater use value for the firm) in producing it. The customer, if asked for a specification, would implicitly assume his/her most common states of use and the requirement analysis would be specified around such declarations. This puts the risk of changing use-contexts squarely on the customer since rigidities have been built into the design of the tangible offering to match the predetermined contexts.
This also makes the tangible offering less agile in its use across contexts but is acceptable in the traditional ‘value’ sense because it is what the customer wanted.

*Proposition 2: A service system of co-creating endogenous use-values must recognise the multiple states (context) of use (experience) which may not yield consistent beneficial outcome for the co-creator whose use value is contextual*

**A Systems Approach.** If use-value is endogenous to all co-creators, the standard scientific approach that surrounds the 3 R’s of reduction, repeatability and refutation (Popper 1972) may not be appropriate. This approach has arisen essentially because many complex problems become easier for scientists to select some aspects of a problem for further detailed investigation. Science follows Descartes’ advice on how to analyse problems by piecemeal, that is, breaking down a phenomena into its elemental parts. However, the reductionist approach is based on a number of assumptions that we should consider before applying it to the problems of engineering service solutions that include equipment, human and technology interactions. The first and most crucial assumption is that when dividing the complex problem into separate parts, we assume that the elements of the whole are the same when examined independently as when they are examined as a whole. This needs careful consideration. If the elements are loosely connected then we can take them apart, analyse them, improve or change them and then put them back together and the whole will be improved. Whilst this may be true for the problems of simple mechanical systems, this assumption may not hold for complex wholes. For example, we cannot take out a part of the body e.g. the heart, modify it replace it back within the body and not expect effects elsewhere.

Systems thinking has a long academic tradition dating back to the open systems concepts of von Bertalanffy (1968) and the control systems work of Wiener (1948). Much academic literature has taken this approach as an alternative to the reductionist view which has dominated much of management as well as engineering research. Reductionism breaks a problem down into its component parts and seeks to optimize each part. At the core of such a reductionist approach are three fundamental assumptions (Ng, Maull and Smith 2010): the connections between the parts must be very weak; the relationship between the parts must be linear so that the parts can be summed together to make the whole; and optimizing each part will optimize the whole.

In contrast, systems which co-create use-value would involve tightly coupled parts; changing one component (e.g. one of the core value transformations) would affect many others, leading to unintended consequences. The interactions within a system of this kind is often highly complex and non-linear (Parry, Purchase and Mills 2010). Buckley (1980) in his masterly essay on the problems of causality in organizations summarizes it thus; “Of particular importance are those kinds of mutual relations that make up circular causal chains; the effect of an event or a variable returns indirectly to influence the original event itself by way of one or more intermediate events or variables”.

As a result, a service system of co-creating endogenous use-values, involving human activities and equipment, has to reject the linear perspective on causality for the richer insights that can be gained from the systems view.

*Proposition 3: A system of co-creating endogenous use-values must take a systems approach*

**Co-Creating Contexts as Variety.** As proposition 2 suggests, the greater the freedom from a single context, the greater the use-value is to the co-creator, which could translate to greater revenues (use value) to the firm. Technology has played a tremendous role in increasing contexts for the use value of offerings. Where telephone calls used to be made physically in a location (at home), customers can now communicate through mobile phones. Therefore, increasing the use value of phones since calls can now fit the customer’s lifestyle and contexts.

Traditionally, in a manufacturing world where there is an obvious production and a consumption system, customer contextual variety in use situations often enters the firm’s system through ‘ports’ (cf. Godsiff, 2010; Weinberg, 2001), where a port is a limited interface that connects the two systems.
More concretely, Frei (2006) proposes five types of customer variety in the system, these types are classified as: request variability (different requirements for each customer); arrival variability (peaks and troughs in service demand); capability variability (customers have differing skill levels); effort variability (some services require customer input/participation and customers will have differing willingness to make effort); and subjective preference variability (different and contradictory views of what constitutes good service) (Godsiff, 2010).

In a system of co-creating endogenous use-values, the system boundaries are blurred and overlapping. Weinberg describes the interface between the customer and the firm no longer as a ‘port’ but as a ‘membrane’, where “an obvious example is the cell wall that may be penetrated at almost every point on its surface, but not by everything and not at all times”. This implies that customer variety permeates through the entire system. Most disturbingly, variety permeation into the system often bypasses the firm’s designed processes, disrupting them and creating complexity. This is paradoxically a consequence of the firm’s original and implicit assumption of use contexts when designing the system. Consequently, rigidities and the creation of closed systems are often utilized as a result of underestimating the number of possible states for the system in requirements engineering.

As Ashby’s law (1956) suggests only variety can destroy variety and thus from a systems perspective, a complex service system can only be viable (cf. Beer, 1981) if the firm attenuates customer variety to match the rigidities of its system, or the firm absorbs the customer’s variety by designing a system that can do so while retaining economic viability. It is therefore no surprise that systems with high human resource can absorb more variety since human beings are capable of a greater number of behavioural modifications and may be able to match the customer’s contextual variety (e.g. being empathetic, smiling). Paradoxically, such interactions by autonomous human behaviors that absorb variety or persuade the customer to attenuate their variety (with a smile) actually result in an improved customer experience (Ng, Nudurupati and Tasker, 2009), thus increasing system viability and stability. Increasingly, we see firms providing pluralistic offerings where human resources are available to absorb customer contextual need while still providing use-value that has been pre-specified, not unlike a caddy on a golf course (who interacts with the customer and fulfils contextual needs) driving the golf cart (the rigid, pre-specified offering).

The role of customers as co-creators and resource integrators has not been very well investigated, particularly around their abilities to realise use-value across contextual states. Using the cup as an example, the customer could decide to buy just a ‘basic cup’ and has resources accessible to himself/herself for realising use-value of the cup in contexts; resources such as a lid (drinking in the garden), a holder (drinking hot beverages) or an assistant (drinking on the move). It is not surprising therefore that service contracts for delivering service and support of equipment may range from merely supplying parts to delivering the availability of the equipment or to delivering the full capability of the customer. Such contracts implicitly assume the degree of resources contributed by the customer and the importance of contexts in achieving outcomes. Where outcomes across several contexts matter, customers may be more inclined to contract on the basic good and do the rest themselves.

Proposition 4: Use value in contexts (customer variety) could be absorbed or attenuated by any of the co-creators of value.

Transforming People. Systems thinking approaches are not new in engineering or for defence systems. Systems thinking has become an accepted domain for the interdisciplinary field of engineering which focuses on how complex engineering projects (such as the Apollo programme by NASA) should be designed and managed, integrating processes and including technical and human-centered activities. However, system engineering and indeed engineering itself struggles with social and behavioural aspects of a system as it has always been associated with “assembling pieces that work in specific ways” (Ottino, 2004) and “a process of precise composition to achieve a predictable purpose and function” (p. 2, Fromm, 2010). Achieving “a predictable purpose and function”, deemed to be core to engineering activity, becomes challenging when the component parts of the system are
people whose activities may not be easily controlled by predictable processes, and who exhibit autonomous human behaviours and yet are component parts of the value co-creating system.

As Wood and Tasker (2010) put it: “The system engineering thinking style is deeply embedded in the development of complex systems, especially defence systems where it has become a universal language: systems of regulation and governance are built on it. Notwithstanding the development of soft systems and similar approaches, system thinking is perceived to be inextricably rooted in the product paradigm ensuring a cultural rigidity inhibiting development of the method to accommodate design in the social space necessary for the attainment of service excellence”.

While inspired by systems thinking, systems engineering also struggles with how to deal with the concept of emergent properties and its related concept of interventions. Emergent properties are often described as properties exhibited by a whole system that do not exist within its component parts, i.e. properties that cannot be identified through functional or component-based decomposition. Emergent properties therefore epitomise the idea that a whole system is greater than the sum of its parts. Emergence is often a result of a complex system and it has been a thorn in the side of systems engineering. In his article about the significant issues that face the US National Academy of Engineering, Wulf (2000) declares that “the key point is that we are increasingly building engineered systems that, because of their inherent complexity, have the potential for behaviours that are impossible to predict in advance”. Within the last decade academic literature in engineering and information systems has attempted to make sense of this phenomenon (Whitty and Maylor, 2008) and develop approaches to aid managers (e.g. Parry, Purchase, Mills, 2010).

When “predictable purpose and function” of complex engineered service systems is oriented towards emergent outcomes (such as experience from interactions), as well as deterministic outputs (turnaround time for repair), engineering as a field of study is further challenged. The challenge of contracting, designing, engineering and delivering contextual use-values that include both deterministic outputs and emergent outcomes sets the agenda for future research in complex service systems.

Recent business-to-business studies (Ng, et. al. 2010) have proposed that transformations that deliver value to customers fall into three generic transformations that interact with one another. The three transformations are the need to (1) transform materials and equipment (i.e. manufacturing and production, store, move, repair, install, discard materials and equipment through supply chain, repairs, obsolescence management, predictive maintenance etc.), (2) transform information (i.e. design, store, move, analyse, change information through knowledge management, information, communication and technological strategies, data strategies in equipment management etc.) and (3) transform people (i.e. train use, change use, build trust through education, influence, build relationships, change mindsets etc.). The study proposed that in the service and support of complex engineering equipment, or systems such as airports or city transportation, what the customer considers as value, or experiences as value-in-use, may no longer be delivered through only one form of transformation but simultaneously through all three.

Similarly, Smith, Ng and Maull (2010) studied where and how use-value is delivered in an equipment based service system when customer use-value is endogenous. Their findings show three cycles of value delivery in equipment based service; the Recovery Value Cycle, the Availability Value Cycle and the Outcome Value Cycle. As the firm moves through the cycles from recovery towards outcomes, delivery requires an increasing involvement from the firm to co-create use value with the customer. In addition, when value is considered as endogenous to the providers delivery system, the firm has to operate in such a way to absorb customer variety – in various use contexts and in multiple desired outcomes. Finally, customer interactions within the system result in customer experience as an emergent outcome, a manifestation of the phenomenological experience. Customer experience is the result of the dynamics of the system, not existing in its component parts. An engaged co-creating customer must therefore be part of the firm’s value proposition so that value can be fully co-created, both extrinsically and intrinsically by the firm and the customer, through a phenomenological experience.
Proposition 5: A service system of co-creating use-values must acknowledge the transformative nature of co-creation on individuals resulting from the interactions within the system.

There is a tendency to attempt to de-risk complex systems to minimise emergence by establishing centralised command and control through reducing autonomous human activity. This may be useful if the objective of the system is to achieve deterministic outputs, but may be erroneous if the system has also to attain emergent outcomes such as customer experience (or perception of service excellence), where the very interactions that are autonomous and unpredictable may be key to contributing to that emergence. Worse still, when applied to value-based systems, the customer within the system that introduces a high degree of variety and exhibits autonomous behaviour, is the very same customer that is to be transformed by the firm as part of an expected emergent outcome. The concept of command and control management, fixed within metrics structures such as SMART (Cross and Lynch, 1988) becomes illusory if systems are to adapt to adsorb variety to achieve use-value. Revenue will be lost in the long term if rigidities are established to provide control that attenuates demand to such a degree that outcomes fail to meet customer expectation. The way managers plan or react to push-back of variety will have subsequent effects upon the costs and the delivery of core transformation processes and over the long term the sustainability of the enterprise.

Conclusion

Competitive advantage may be gained through creating the capability to continuously adapt and co-evolve within the complex environments created, embedding a system capable of undergoing continuous metamorphosis in order to respond to a dynamic business landscape (Brodbeck, 2002). However the rewards for the supplier may not correlate with their capability as it is suggested that it is the customer’s perception of use-value, not that of the supplier which determines its behaviour (Ng et. al., 2010; Wikström et al 2009).

From the three lemmas and five propositions, we argue that a value-centric approach to co-create a valued offering must put use-value at the centre of a service system. Consequently, to achieve use value for the customer, the firm has to ask how value is co-created and understand the role of the customer within that space (Lengnick-Hall, 1996). Our paper provides the first step towards a foundation for design and delivery of value propositions for co-creating use-value in service systems.

References


Albrecht, K. (1992). The only thing that matters. Executive Excellence, 9, 7 (November)


Bengtsson, David (2004), Pleasure and the Phenomenology of Value, working paper


Haglund, B. (1988) Report on discrimination powers for Hartmann-type value hierarchies. Research Report, Department of Philosophy, University of Gothenburg,


Long, & Carroll (1999)


Plato (360 B.C.E) *The Republic*


Rushkoff (2005)


Smith, A. (1776). The wealth of nations, Books I-III. Wiley, Chichester


