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How business customers judge solutions: solution quality and value-in-use

Emma K. Macdonald
Associate Professor of Marketing
Cranfield School of Management
Cranfield University
Bedfordshire, MK43-0AL, UNITED KINGDOM
Emma.Macdonald@cranfield.ac.uk

Adjunct Senior Research Fellow
Ehrenberg-Bass Institute for Marketing Science,
University of South Australia, AUSTRALIA

Michael Kleinaltenkamp
Professor of Business and Services Marketing
School of Business and Economics
Freie Universitaet Berlin
14195 Berlin, GERMANY
+49 (0)30 838-524 71
Michael.Kleinaltenkamp@fu-berlin.de

Hugh N. Wilson
Professor of Strategic Marketing
Cranfield School of Management
Cranfield University
Bedfordshire, MK43-0AL, UNITED KINGDOM
Hugh.Wilson@cranfield.ac.uk

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Abstract

Many manufacturers look to business solutions to provide growth, but success is far from guaranteed, and how solutions can create superior perceived value is not clear. This article explores what constitutes value for customers from solutions over time, conceptualized as value-in-use, and how this arises from quality perceptions of the solution's components. A framework for solution quality and value-in-use is developed through 36 interviews combining repertory grid technique and means-end chains. Significantly extending the extant view of quality as a function of the supplier's products and services, findings show that customers also assess the quality of their own resources and processes, and of the joint resource integration process. Contrasting strongly with prior research, value-in-use corresponds not just to collective, organizational goals but also to individuals' goals. Four moderators of the quality-value relationship demonstrate customer heterogeneity across both firms and roles within what the authors term the usage center. When shifting towards solutions, manufacturers require very different approaches to market research, account management, solution design and quality control, including the need for a value auditing process.

Keywords: Business solutions, customer perceived value, quality, resource integration, repertory grid, means-end chains

Under pressure from market maturity and globalization, many manufacturing firms are looking to services for growth in revenue and profits (Kowalkowski et al. 2015). While in some instances services and products form distinct offers, a significant trend from automotives and aerospace to pharmaceuticals and IT is to provide solutions, "products and services combined into innovative offerings" (Shankar, Berry, and Dotzel 2009, p. 95). We adopt this as a working definition, though we subsequently refine it in light of our findings. Worldwide about 30% of manufacturers provide such solutions, ranging from 20% in China to 55% in the US (Neely, Benedettini, and Visnjic 2011).

Solutions promise to provide differentiation where the core product is becoming commoditized. An example is Rolls-Royce's archetypal solution TotalCare, begun in 1997 with American Airlines, which combines an engine and its servicing in a long-term contract. As the manufacturer retains reliability data across numerous airlines, it can accurately predict and pre-empt engine problems, providing a reliability benefit as well as reducing the airline's financial risk (Kim, Cohen, and Netessine 2007). While GE soon launched its own variant, the Rolls-Royce model has proved difficult to copy. Solutions can also enable suppliers to compete in expanded profit pools, providing a route to growth for firms such as Xerox and IBM in industries where equipment prices have fallen dramatically over the last 20 years.

Shifting towards solutions is, however, far from a guaranteed route to improved performance. Manufacturers offering product-service solutions on average appear to have lower profits than those that do not (Neely 2008). Supplier margins may decrease, particularly early in such a transition when services provide less than 20-30% of turnover (Fang, Palmatier, and Steenkamp 2008). It would appear that solutions providers face a sharp learning curve, but what they need to learn is not clear.

There has been some research progress in helping manufacturers understand what drives successful solutions. For example, through supplier interviews Ulaga and Reinartz (2011)

identify capabilities needed by suppliers, calling for complementary research with customers. Tuli, Kohli, and Bharadwaj (2007) find that suppliers and customers indeed see solutions differently: whereas suppliers tend to view solutions as simply a bundle of products and services, customers emphasize the importance of the relational processes of solution design and delivery. Processes can be defined as "the procedures, tasks, mechanisms, activities and interactions that support the co-creation of value" (Payne, Storbacka, and Frow 2008, p. 85). These solution processes draw on a set of resources (Ulaga and Reinartz 2011), the tangible and intangible entities available to the firm which enable it to produce a market offering that has value for some market segments (Hunt and Madhavaram 2012); an example of such a resource is Rolls-Royce's engine reliability database. The research challenge remains to explore how a solution combining these processes and resources succeeds or fails.

In this article, we take a customer perspective to this challenge, guided by the overall research question: how do business customers judge solutions and the value they create? Despite the fundamental position of value within the marketing discipline (see the AMA's (2013) definition), practitioners continue to express difficulties in understanding the drivers of customer perceived value (Marketing Science Institute 2014). Scholarly work on this issue focuses on the concept of quality, with a substantial body of both conceptual (Woodruff 1997; Zeithaml 1988) and empirical (Bolton and Drew 1991) literature examining product and service quality as antecedent to value. Solutions are, though, more than the sum of their product and service parts (Tuli, Kohli, and Bharadwaj 2007; Ulaga and Reinartz 2011). Solutions solve a business problem not simply by enhancing the quality of component products and services but through integration of these components (Nordin and Kowalkowski 2010; Storbacka 2011). For example, the increased flight reliability claimed by Rolls-Royce's TotalCare results from the taut integration of product features such as automated engine state reporting, services such as dynamic maintenance scheduling, and the airline's own processes

such as flight scheduling. There is thus a need for grounded discovery of how the quality of solutions is judged. Our first objective is therefore to explore how customers assess solution quality. Following Zeithaml (1988), we define quality as the perceived excellence or superiority of an entity, in this case a solution.

Implicit in our research question is the further requirement to explore what value from solutions comprises. Empirically, value has received less attention than quality. While some prior work examines value in business markets (Ulaga and Eggert 2006), the constructs by which the value of solutions is judged have yet to be explored. Our second objective is therefore to understand what constitutes value for solution customers. In this relational context, this value perception is of interest not just at the moment of exchange but throughout the solution's relational processes. We accordingly draw on service literature and focus on value-in-use (Grönroos and Voima 2013; Vargo and Lusch 2004), which we define, adapting previous definitions (Macdonald et al. 2011; Payne, Storbacka, and Frow 2008; Woodruff 1997), as all customer perceived consequences arising from a solution that facilitate or hinder achieving the customer's goals. We expand on this definition in the following section.

We address our research question through 36 interviews of industrial solutions customers, using repertory grid technique (Goffin and Koners 2011) along with means-end chains (Reynolds and Gutman 1988) to explore the links between quality and value. We thereby make three main contributions to literature on quality, value and solutions. First, we find that customers assess the quality not just of the processes and resources of the supplier but also of customer and joint ones—a significant extension of the quality concept (Golder, Mitra and Moorman 2012) which may apply more broadly in both business and consumer markets. Second, we find that customers link their solution quality perceptions to individual value-in-use constructs as well as collective ones. This significantly extends the dominant view of value in business markets as a function of organizational goals (Ulaga and Eggert 2006);

equally, it contrasts in the opposite direction with the dominant typologies of consumer value which relate exclusively to the goals of the individual, even if some of these goals such as status relate to the individual's position in social groups (Holbrook 1999; Sheth, Newman, and Gross 1991). Third, we identify moderators of the relationship between solution quality and value-in-use, demonstrating heterogeneity in how solutions are judged arising both from the manager's role in what we term the usage center, and from firm characteristics.

Overall, these findings suggest a very different view of value from that which predominates among both scholars and practitioners. A solution's value proposition is not proposed by the supplier alone but is jointly designed by the supplier *and* the customer; it depends on the quality not just of the supplier's resources and processes but also of customer and joint ones; and the value that arises is not predetermined and simply verified (Storbacka 2011) but is, rather, continually optimized by both parties. Shifting towards solutions therefore involves far more than pricing a product/service bundle. For example, suppliers need a joint resource integration effort with the customer to take customization decisions such as where the boundary between the firms should lie; they require competences in optimizing not just their own processes but also those of the customer; they need to continually audit and enhance the value from the solution, rather than simply meeting the contract; and they require market research that extends beyond the customer's judgement of the supplier to include the customer's judgement of their own resources and processes.

The article proceeds as follows. We expand on our conception of value-in-use and solution quality. We then explain our use of repertory grid and means-end chains. An overview of the emergent conceptual framework is followed by sections detailing value-in-use, solution quality, and moderators of their relationship. Finally, we discuss theoretical contributions, including a refined definition of solutions; practitioner implications; and research directions.

Understanding solution quality and value-in-use

Table 1 shows exemplars of empirical work on value, with an emphasis on studies that explicitly or implicitly also include quality perceptions. In some earlier literature the terms are almost equivalent, value being seen as a function purely of quality and price (Cronin, Brady, and Hult 2000; Desarbo, Jedidi, and Sinha 2001). More commonly, quality is distinguished from the anticipated or realized benefits of a product or service (Bolton and Drew 1991; Ulaga 2003), while price is generalized to costs (Ulaga and Eggert 2006), sacrifices (Faroughian et al. 2012), or "what is given" by the customer (Zeithaml 1988).

Insert Table 1 about here

The relationship between quality and value (Zeithaml 1988) can be conceptually underpinned by goal theory (Woodruff 1997). Individuals have a goal hierarchy in which higher-level 'abstract goals' such as the desire to protect the natural environment relate to lower-level 'concrete goals' such as to buy a hybrid electric car (Barsalou 1991; Peterman 1997). Similarly, a manufacturing manager may associate the abstract goal of overall equipment effectiveness with the concrete goal of fast response times for repairs (Macdonald et al. 2011). The customer essentially hypothesizes a causal chain or 'ladder' (Reynolds and Gutman 1988) from product features to their desired outcomes from use—the concept of attribution (Raghubir and Corfman 1999). These outcomes constitute value-in-use — generally interpreted as the customer's functional and/or hedonic outcome, purpose or objective that is served through product/service usage (Woodruff 1997).

These goals may be preventative, such as avoiding high prices, or promotional, such as looking good to others (Chitturi, Raghunathan, and Mahajan 2008). A goal-based conception of value-in-use hence integrates the notions of benefits and sacrifices, as a sacrifice such as a high price corresponds to low achievement of the goal of minimizing the price paid (Macdonald et al. 2011). Similarly, customers may have a goal to minimize their effort

(Mathwick, Malhotra, and Rigdon 2001). With this goal perspective, the notion of trade-offs of benefits against sacrifices is more precisely described as the customer balancing and prioritizing between all goals (Epp and Price 2011).

Further work has extended the application of goal theory to suggest that value arises not only through product usage processes but at any point in the customer journey (Lemke, Clark, and Wilson 2011). This has led to the suggestion of such alternative terms as value-in-context (Vargo and Lusch 2016), value-in-social-context (Edvardsson, Tronvoll, and Gruber 2011), and experiential value (Mathwick, Malhotra, and Rigdon 2001). While we adopt the term value-in-use to avoid unnecessary terminological multiplicity, its definition needs to allow for goals to be met at any point in the relational process of a solution; hence our definition of value-in-use provided earlier as all customer perceived consequences arising from a solution that facilitate or hinder achieving the customer's goals.

This definition distinguishes value-in-use from value-in-exchange, the product or service attributes promised by the supplier and expected by the customer at the time of purchase (Grönroos and Voima 2013). This does not automatically translate into value-in-use, which is also dependent on other resources, such as a customer's own skills, and other processes, such as peer-to-peer processes (McColl-Kennedy et al. 2012). In this vocabulary, some studies referring simply to value examine value-in-exchange (e.g. Sweeney and Soutar 2001) while others examine value-in-use, such as Sirdeshmukh, Singh, and Sabol (2002)'s study of the value perceived through service delivery.

The customer's role in creating value-in-use also has implications for quality. Literature on quality overwhelmingly assumes that value arises from the quality of the *supplier's* offering (Zeithaml 1988; Ulaga and Eggert 2006). Golder, Mitra, and Moorman (2012), however, call for further focus on the under-researched topic of the quality implications of co-production. In a solutions context, if value is "realized from integration of resources

through activities and interactions with collaborators in the customer's service network" (McColl-Kennedy et al. 2012, p. 1), the question arises whether customer evaluation is focused not just on supplier processes but also on customer ones (Payne, Storbacka, and Frow 2008). This leads us to ask whether these customer processes, too, have a quality—a perceived excellence or superiority.

From these concepts follow a number of implications for empirical work, as illustrated in the column headings of Table 1. First, in order to understand how solution quality leads to value-in-use, it is necessary to allow for the possibility that the customer may make quality appraisals not only of supplier processes and resources but also of customer ones. Second, as goals are multifarious, value-in-use is inherently multidimensional. Hence, it is important to understand the more granular constructs by which value is perceived (Ulaga and Eggert 2006). Third, as value-in-use is inherently phenomenological (Vargo and Lusch 2016), it may be perceived differently by different people within the customer firm. We define the group of individuals involved in the use of a solution as the usage center. While most previous research has focused on a single informant—most commonly a purchasing manager—to represent each customer firm, exploration of value-in-use requires the perspectives of multiple members of this usage center. Fourth, goal theory suggests that individuals have both their own individual goals and shared, collective goals (Epp and Price 2011). While consumer research has been criticised for dominantly ignoring collective goals (Epp and Price 2011), Table 1 illustrates our earlier observation that the opposite bias may be present in business research, in which value is assumed to be purely collective, despite the known importance of personal motivations in decisions on suppliers (Johnston and Bonoma 1981).

In a solutions context, one would expect uncovering value-in-use perceptions and not just quality perceptions to be particularly critical to an understanding of what makes for successful solutions. Solutions are not only customized (Nordin and Kowalkowski 2010),

they also affect such fundamental issues as the division of tasks between customer and supplier firms (Macdonald et al. 2011). For example, Rolls-Royce has taken over large numbers of service personnel from some of its TotalCare clients. Comparing two options such as in-house maintenance versus adoption of TotalCare cannot readily be done on the basis of product or service quality alone, as the very entities being compared differ substantially. Instead, one would expect such diverse solutions to require comparison further up the goal hierarchy at the level of value-in-use (Storbacka 2011): in this instance, by judging the extent to which the total solution keeps the plane in the air at maximum reliability and minimum total cost—hence Rolls-Royce's trademark "Power by the hour".

Accordingly, in our empirical work, we elicit from multiple members of the usage center how solution quality is appraised, while allowing for the possibility that the answers may extend beyond the quality of supplier inputs alone. We also explore how these quality appraisals relate to the multiple facets of value-in-use, without prior assumption as to whether customer goals are collective, individual, or both.

Research Method

Sample

We study members of the usage center in four manufacturers, eliciting their solution quality and value-in-use perceptions relating to factory equipment and its maintenance, repair and operations. The firms were in a spread of sectors: medical devices (which we call DeviceCo), printing (PrintCo), pharmaceuticals (HealthCo), and building products (BuildCo). Solution innovation in factory equipment includes not only maintenance but also such services as parts procurement and stores management (Kastalli and Van Looy 2013). In each company, an exploratory interview led to identification of other usage center members. A sample was drawn up representing four main usage center roles that emerged: maintenance, operations, purchasing, and general management. 8 to 10 interviews were held in each company, totaling

36 interviewees. Interviews averaged 47 minutes. See Table 2.

Insert Table 2 and Table 3 about here

Insert Figure 1 about here

Data collection and analysis

We synthesized literature on repertory grid technique, means-end chaining, and qualitative data reliability to develop a robust method for eliciting quality and value constructs and their relationships: see Table 3. Deriving from Kelly's (1963) personal construct theory, repertory grid technique uses structured interviews to identify the constructs by which human judgements are made. It is useful when these judgements are from tacit knowledge (Brown and Detoy 1988) and it has high test-retest reliability (Smith 2000). Applications within management include supplier quality (Goffin, Lemke, and Szwejczewski 2006), cognitions about IT (Tan and Hunter 2002), new product development (Goffin and Koners 2011), and experience quality (Lemke, Clark, and Wilson 2011). We used the technique to identify the constructs by which interviewees judge solutions. As these constructs were generally at the more concrete level of quality in the customer's goal hierarchy, we combined the technique with means-end chains, or laddering (Gutman 1982), to elicit the more abstract value constructs. See Figure 1 for an example grid and related ladder.

Following Goffin, Lemke, and Szwejczewski (2006), the first stage of analysis identified quality constructs (Table 4) and value-in-use constructs (Table 5) from the grids and transcripts, and named these with reference to literature following the approach of Gioia, Corley and Hamilton (2012). Following Tuli, Kohli, and Bharadwaj (2007) amongst others, inter-coder reliability was checked with the proportional reduction in loss method (Rust and Cooil 1994).

The second stage of analysis involved recording ladders between constructs and deriving from them an implications matrix which summarizes the links, or 'implications', between quality and value constructs (Reynolds and Gutman 1988). See Table 6, which also includes

three indices summarizing the role of constructs: abstractness is the average level of a construct in the ladder from concrete (approaching 0) to abstract (approaching 1); centrality measures how often a construct appears in a ladder; and, prestige is an index of how often a construct is the destination in implications, as a proportion of all implications in the matrix (Pieters, Baumgartner, and Allen 1995). A more detailed implications matrix is provided in the Web Appendix. From this matrix, we drew up a hierarchical value map summarizing the constructs and their relationships (Reynolds and Gutman 1988, Gengler and Reynolds 1995): see Figure 2. To examine customer heterogeneity, Figure 4 shows similar maps for sub-samples including companies and roles. See Table 3 for further details of the method.

How value-in-use arises from solution quality

Tables 4 and 5 present solution quality and value-in-use constructs, with definitions and illustrative quotations. (The code following each quotation indicates company, interviewee and construct number; for example, H2-15 is construct #15 elicited from HealthCo's Interviewee #2.) The relationship between solution quality and value-in-use is reported in the implications matrix (Table 6) and the related hierarchical value map (Figure 2). We integrate these findings in the framework of Figure 3, and begin with an overview based on this figure.

Insert Tables 4, 5 and 6 about here

Insert Figures 2 and 3 about here

In evaluating a solution, customers assess the quality not just of the supplier's resources and processes but equally of their own. Furthermore, the resource integration process for which both parties are responsible plays a central role, drawing upon resources from both, and in turn being central to value creation. Suppliers, then, do not *deliver* solutions; rather, suppliers and customers co-create them. This joint contribution to solution quality is a significant departure from the weight of research into quality, which regards quality only as a function of the supplier's actions. It is also at odds with common market research practice, in which

suppliers ask customers purely about their assessment of the supplier and not their assessment of their own processes or indeed joint ones.

This symmetry between supplier and customer is also seen in two further processes: value auditing by the supplier and by the customer. The supplier's value auditing process extends the set of solution processes identified by Tuli, Kohli, and Bharadwaj (2007). Furthermore, this monitoring and optimizing of value-in-use is equally an important *customer* process—and both of these processes themselves form part of the customer's quality assessment.

An emergent finding is that the value-in-use that is thereby co-created is individual and not just collective. Managers within a usage center perceive multiple dimensions of both collective value-in-use, constructs relating to the goals of the organization, and individual value-in-use, constructs relating to the individual's personal role and interests. This is in stark contrast to the predominant, albeit implicit, view of value in business relationships as a function of organizational outcomes alone (Ulaga and Eggert 2006). We next consider the components of Figure 3 in more detail, beginning with value-in-use and followed by solution quality, before turning to heterogeneity in quality and value perceptions.

Collective value-in-use

As might be expected, several of the nine collective value-in-use constructs (see Table 5) relate to improved operational performance of the customer firm: *avoiding downtime*, *fast problem-solving*, *low costs*, and *fixed capital reduction*. *Process improvement* to the customer's processes is valued both in itself (centrality=.15, second only to low costs among value-in-use constructs; details are available in the Web Appendix) and as a means to achieve these operational gains (abstractness=.69, the least abstract of the value-in-use constructs); here we again note the centrality of the *customer's* processes in solution success. Operational performance is a core motivation for solutions and frequently forms the basis for pre-sale conversations with suppliers (Ulaga and Reinartz 2011), though we found that achievement

of performance gains is only rarely embedded in the contract, despite research attention to performance-based contracting (Kowalkowski et al. 2015).

Two further constructs represent value which is more likely to be emergent through the solution: the solution's impact on the *innovativeness* and *competitive advantage* of the customer. For example, a central stores manager commented on the importance of innovative ideas within his somewhat traditional printing firm: "I'm quite positive that we needed somebody from an outside industry to lead us a bit more. Yes, I would say there is an improvement because you've got a different opinion, different angle from an outside firm." (P6-24). *Competitive advantage* occurs where the solution improves the customer's own market position. This formed part of the solution appraisal by an engineering manager in DeviceCo: "these guys have a much more commercial focus, whereas [supplier] has been treated up to now as an improvement to our service, as opposed to 'can you give us any competitive advantage?'" (D2-84). These value-in-use constructs go beyond those typically seen in business value research (Ulaga and Eggert 2006). Their emergent nature raises the issue of how either party can track their occurrence; this forms part of the role of the value auditing processes which we return to later.

Two final constructs correspond to preventative goals and, in particular, risk management. A solution can result in *reduced financial risk* through the supplier taking on this risk. Equally, the resource integration process may provide better risk management with third parties, as discussed at PrintCo: "if there's a problem with anything breaking in warranty [with any of our suppliers] then [a representative from the solution provider] would recover this money as well" (P6-28). In the opposite direction, *dependence avoidance* is expressed in the concern that through the transfer of some responsibilities to the supplier, the customer risks losing competencies such as sourcing expertise. This was a concern aired by interviewees at PrintCo, for example: "It's no use putting all your eggs in one basket, as they

might be a global supplier but it's no good if all they can get us is in [city name]" (P5-35). While these risk-related constructs are absent from much literature on business value such as that reviewed in Table 1, they seem a natural consequence of the redrawing of boundaries between supplier and customer that can occur in a solution's resource integration process (which we consider in more detail below). We summarize these observations as follows:

> **Proposition 1:** Collective value-in-use includes emergent dimensions which may go beyond those anticipated at the time of exchange.

Individual value-in-use

Extending previous work on how business customers judge value, we found that six constructs corresponding to goals of the individual form part of the evaluation of the solution. Three relate to job ease (Glass and Camarigg 1992). The first is *task simplicity*, the simplicity and time efficiency of the processes comprising one's job. For example, PrintCo's outsourcing of day-to-day operations of a factory's production line stores had a beneficial impact on the working life of the stores manager: "I'm responsible overall for all procedures governing all our stores. I am still linked with the repairs, but obviously [supplier] now manage it day to day, whereas before I was actually doing it all the time" (P6-1). BuildCo's maintenance manager found on the contrary that a solution did not aid task simplicity: "It doesn't get my job done…and by the time I have explained to him, what's the point? I can do the job myself" (B4-13). Task simplicity is valued in part due to its impact on work-life balance. A related and also commonly occurring construct is *pressure reduction*, minimized pressure and stress in one's daily job. Typical is an engineer at HealthCo who preferred a solution which reduced the personal pressure on him when equipment failed: "It'll save you stress and pressure: when you're designing something you're not under pressure, because you know that if you make an improvement it's a plus, whereas if a [production] line is down, there's pressure and that is very important" (H2-48). The third construct relating to job ease is

perceived control, a perception of control over processes and resources comprising one's job. A project engineer appreciated the control benefits of a solution which involved an on-site customer representative at DeviceCo: "They are on site, yes, so I suppose I have a neck to grab at the end of each evening if something goes wrong" (D8-4). The pressure reduction and perceived control constructs are in line with the insights of stress theory (Lazarus 1990) that the degree of perceived stress has an impact on the assessed quality of an encounter.

The fourth of the individual value-in-use constructs is *uncertainty reduction*, minimized uncertainty related to processes and decisions comprising one's job. This is illustrated by a maintenance technician at HealthCo: "some suppliers will work with you and collaborate with you, so you get a sense with them of complete confidence; you stop challenging, questioning, seeing every report because you know they're going to deliver, they're going to take care of it" (H9-52). This echoes research in the service sector showing that customers seek to reduce their perceived uncertainty and purchase anxiety during the buying process (Berry 1995); our data show that reducing uncertainty is also valued after the sale.

The final two constructs relate to the individual's social context. *Personal reputation*, being viewed as a person with high job competence, can be affected negatively as well as positively by the quality of the solution. A maintenance manager at DeviceCo relayed the reputational damage to him and his team that could arise from a supplier's slow response time compounded by lack of skills in the customer organization: "It's not good for us to be saying we can't fix it…We're not trained enough, so we're under pressure straight away and we look poor…because [supplier staff] can't come on site" (D7-13). *Social comfort*, feeling comfortable with other people involved in one's work, is a function of individual personal relationships. It can also be aided by processes which lead to repeated contact with the same person, as observed by DeviceCo's maintenance engineer: "Working with the individuals is

the main thing. If you can't work with the individual who's sorting out your problems, where are you going? It's all personal. All day, every day I'll be with him" (D8-11).

The role of individual motivations has largely been ignored in the literature on organizational buying behavior (a notable exception being Hollman, Jarvis and Bitner, 2015). Yet our data show that individual value-in-use plays a substantial role in solutions evaluation (centrality=.32, against centrality of collective value-in-use of .60; see Table 6). Hence:

> **Proposition 2:** The value-in-use from solutions is judged relative to the individual goals of usage center members (individual value-in-use) and not just organizational goals (collective value-in-use).

Individual and collective value-in-use have very similar abstractness (.81 and .83 respectively). Table 6 shows that individual value-in-use sometimes ladders to collective value-in-use (36 direct implications); for example, an individual's task simplicity can lead to fast problem solving (9 implications). Equally, collective value-in-use can ladder to individual value-in-use (36 implications); for example, fast problem solving can lead to pressure reduction for an individual (5 implications). We therefore propose:

> **Proposition 3:** Individual value-in-use and collective value-in-use interact, as the achievement of individual goals can support collective goals and vice versa.

Supplier Resource Quality and Customer Resource Quality

We next turn to solution quality, beginning with resource quality. We have commented that extant quality research across multiple sectors dominantly views value as arising from the quality of what the *supplier* provides. Our data show that solution customers do indeed judge supplier resource quality at three levels: employee, organization and network. This evaluation is, however, mirrored in their assessment of the quality of their *own* resources, as can be seen in Table 4, though a fourth construct, customer orientation, is found only in the supplier evaluation. The interplay between customer and supplier resources in solution design is exemplified by a maintenance coordinator from HealthCo discussing the importance of

employee competence within both firms: “In terms of operating equipment, you can’t just replace your in-house technical people and expect new people to walk in and know how to operate the plant. There’s a lot of experience built up” (H4-24). To our knowledge, research has not previously examined the quality of customer resources as an input to solution quality.

Furthermore, previous business research has dominantly overlooked the quality of both the supplier’s network and that of the customer. In our data, *sourcing network competence* was prominent, the supplier’s competence appearing in 25 of the 36 interviews and the customer’s in 22 interviews. For example, a BuildCo engineering manager positively reflected on this competence of a supplier: “he has a network of sourcing the suppliers which covers a multitude of repairs that we need. He takes care of that” (B1-8). Where the supplier’s sourcing network competence exceeds that of the customer, it can make sense for the resource integration process to transfer sourcing responsibilities. Both a general manager and a maintenance professional commented on this at HealthCo: “Because they have power within purchasing, they get it so much cheaper” (H3-24); “[Supplier] could go to [sub-supplier] and buy directly from them, so there’s a multitude of doors that are opened from [supplier]” (H5-29). This is consistent with the social network perspective on inter-organizational relationships, which shows the importance of the supplier’s network (Palmatier et al. 2008), and this is particularly the case for solution providers (Möller and Törrönen 2003). Importantly, as well as evaluating the supplier’s network competence, customers judge their own network competence, as illustrated by this comment from a maintenance team leader at HealthCo: “What happened originally was the team leaders made contact with contractors to get service but nobody [had] oversight of the whole issue, nobody had a look at why we had contractors here doing the same work as down there” (H7-5).

The quality of these supplier and customer resources in turn influences resource integration quality, providing empirical support for recent conceptual literature which stresses

that value-in-use emerges from resource integration (Grönroos and Voima 2013; Vargo and Lusch 2016). Equally, however, supplier and customer resource quality frequently ladder directly to value-in-use at both collective and individual levels (see Table 6). In conclusion:

> **Proposition 4:** In addition to supplier resource quality, customer resource quality is instrumental in contributing to value-in-use.

Resource Integration Process Quality

Beyond the quality of customer and supplier resources, the quality of the resource integration process plays a central role not only within solution quality assessments but also as a driver of value-in-use (centrality=.45, second only to collective value-in-use). As might be expected, resource integration process quality is itself dependent in part on the quality of the supplier resources (with 73 direct implications) and customer resources (with 41 direct implications) being integrated, so in means-end chain terminology it frequently acts as a consequence bridging from resource attributes to value (Reynolds and Gutman 1988) (abstractness=.31, as against .12 for supplier resources and .14 for customer resources).

The first construct through which resource integration process quality is judged is *coordination effectiveness*, mentioned by every interviewee (centrality=.26). Service quality literature has examined supplier-customer interaction extensively, but in general with the perspective of judging the supplier's role rather than joint processes (Golder, Mitra, and Moorman 2012). Our data show, however, that customers are aware that coordination takes two parties. For example, an engineering manager at BuildCo acknowledged his firm's role in allowing a supplier representative to coordinate effectively, in part by creating a local working space: "He has an office in the stores now and we have given him the ability to access our computer system to book in deliveries and so on and do the basics" (B1-11). This is consistent with Joshi's (2009) finding that collaborative communication enhances supplier knowledge, supplier commitment and hence supplier performance.

The second construct of resource integration process quality is *asset management effectiveness,* which concerns the coordination of assets rather than information flows. It involves collaborative decisions on such issues as the best place to hold stock, the best process to deliver physical assets, and whether inventory management is best outsourced to a supplier. A maintenance technician at DeviceCo, for example, described improvements to joint asset management as a result of a solution: "You can search on your machine under product type and part number and find it a lot quicker. And he [on-site supplier representative] manages it better so you don't have to order as many, so we're carrying less inventory" (D9-4). Effective asset management too, then, is a result of shared processes. Hence:

Proposition 5: In assessing the value-in-use of solutions, customers assess the quality of the joint resource integration process, which in turn draws on customer and supplier resource quality.

Value auditing by the customer and the supplier

Value-in-use is by definition perceptual. In a usage group with multiple members, the question arises how these perceptions are formed and shared. This is an issue of instrumental concern for managers within both customer and supplier firms, as value perceptions impact future buying decisions. Extending the solution processes identified by Tuli, Kohli, and Bharadwaj (2007), we identify a value auditing process within the supplier that is sufficiently important to form part of the customer's solution quality assessment. This process involves both *value-in-use monitoring* and *value-in-use optimizing*. The monitoring of value-in-use achieved is illustrated by a technical services manager at DeviceCo: "[Supplier representative] would come down with the list of items that has been ordered through him versus our old costs and show if we were originally paying 500 Euros for a part and they got it for 450." (D1-35). Storbacka (2011) reported that suppliers believe that value verification by the supplier is an important part of solution delivery. Our data show that customers agree,

and furthermore that this value auditing is quality-assessed by the customer. Moreover, we find that a closely related value auditing process in the *customer* firm is also quality-assessed as part of solution quality appraisal. An engineering manager, for example, reported that "we typically have a weekly review internally with the value teams here where they have to review usage and cost. I have engineers in each of the teams who are responsible for the consumable spend on a weekly basis and who get measured as part of their performance appraisal. So [the supplier] guys work very closely with our engineers to make sure they've got the information" (D2-39).

This process of value monitoring and optimization goes considerably beyond the traditional role of quality control. Customers wish suppliers not just to deliver their part of the contract to high quality but also proactively to seek further ways beyond the contract to add value. Furthermore, the quality of this value management is itself assessed by the customer. As these value auditing processes focus on explicit and generally measurable benefits to the firm, it is not surprising that our data show the respective quality assessments are primarily linked with collective value-in-use constructs, with relatively few links to individual value-in-use (see Table 6 and Figure 2). Thus:

> **Proposition 6:** The quality of value-in-use auditing processes by the supplier and the customer impacts collective value-in-use.

Differences across employee roles and customer firms

An important issue for suppliers is whether there is heterogeneity in quality and value-in-use perceptions across employee roles and customer firms. We reflected on differences between interviewees both in the qualitative data and in the formal laddering analyses. We thereby identify four moderators of the quality-value relationship: see Figure 3b.

Resource integration involvement

It was striking in the interviews that employees who were intimately involved in the resource integration process on a day-to-day basis, typically from maintenance and operations, spoke

more about individual value-in-use than those in general management and purchasing. For employees who are more embedded in the core resource integration process, it seems that solution quality has a greater impact on their individual job performance and well-being. For example, for a maintenance project engineer (D8), the supplier's responsiveness to an emerging problem led to task simplicity for him: "I have two guys on the plane to solve the problem. They took it seriously; that was at 6 o'clock this evening, they are landing in [city] for 1 o'clock to solve it. That's important to me because at least I've not then got tomorrow with the issue." By contrast, similar stories from general and purchasing managers tended to end with a collective goal such as reduced financial risk rather than an individual goal.

To explore this insight, we drew up hierarchical value maps by job role (see Figure 4: 4a to 4d).[1] Following Overby, Gardial and Woodruff (2004), we use a comparison of means test on construct centrality to check the apparent difference between maintenance and operations staff on the one hand, and purchasing and general management on the other[2]. Individual value-in-use is significantly more central for the former (mean of centrality=.40, SE=.04) than the latter (centrality=.18, SE=.05) and a large effect (t= 2.77, p=.009, *d*=1.14). Hence:

> **Proposition 7:** Resource integration involvement moderates (enhances) the relationship between solution quality and individual value-in-use.

Insert Figure 4 about here

Role extraversion

The extent to which the individual's job role is focused on the contribution of outside suppliers we term *role extraversion*. We found that some interviewees whose role focused on managing suppliers accordingly focused more on supplier resources in creating value,

[1] As with Figure 2, we used a cut-off of 1% of implications, with a minimum of 5 implications for job roles where the total number of implications was less than 500, following Gengler and Reynolds (1995). See Method Step 14 in Table 3.

[2] We follow these authors as well as Tuli et al. (2007) in warning that in qualitative research such as this in which a purposive sample is neither random nor independent, such statistical examination should be regarded as exploratory in the interests of generation of plausible theory which appears consistent with the data collectively, and not as theory testing.

whereas others had a more symmetrical view about the contribution of their own organization's resources as well. For instance, PrintCo's Procurement Manager referred little to customer resources in his extensive discussion of a solution: "[Supplier] has quite a presence on site as far as plant and equipment is concerned, and a lot of the software that our plant and equipment is running on is [supplier]-based…With a potential turnover of anything up to 5 million pounds a year, the main thing is how much money can they save us. The commonly held belief is that they have saved us money" (P8-4; P8-14). Conversely, the operations manager in charge of the store room repeatedly referred to customer resources that needed improving, before explaining how joint resource integration leads to collective value: "The purchase repairs that hadn't been cleared up were going back 15 years and they'd never been closed. We and [supplier] now get together and say 'this is going to happen at this point' and then we'll be more specific with dates and times…If you know what's going to happen, you can plan your plant and say, this part is going to be away; if we haven't got a spare, then this is the time it's going to take. You don't want to have the same downtime twice for the same fault on the same part" (P2-19; P2-29).

Customer resources, then, are significantly more central for those in an internally focused or balanced role such as operations or general management (centrality=.23, SE=.04), and less central for those with an externally focused role dealing with suppliers on a constant basis, such as in purchasing and maintenance (centrality=.13, SE=.03) (t=2.22, p=.033, a large effect: *d*=.75). These results help explain differences in our findings as compared with previous work in which purchasing managers mainly serve as respondents (e.g. Ulaga and Eggert 2006). Following this discussion we propose:

> **Proposition 8:** Role extraversion moderates (reduces) the relationship between customer resource quality and: a) resource integration process quality; b) value-in-use (collective and individual).

Solution ownership

A third way in which heterogeneity exists by role is the extent to which the value auditing processes were an important part of the solution quality assessment. This appeared to depend on the extent to which the individual has responsibility for solution outcomes. We call this solution ownership. As is evident from Figure 4, general managers and, to a lesser extent, operations managers placed emphasis on both supplier and customer value auditing processes as important for both tracking and optimizing value-in-use. For HealthCo's Engineering Manager, for example, explicitly linking these processes was important: "[A supplier] would provide us with a monthly scorecard, and I would sign off on the hard savings on agreed KPIs. If they saved us less than 45,000 Euros then that's all they got paid. If they saved us 100,000 Euros they get paid 45,000, so that's a very attractive option for any manufacturer" (H10-35; H10-38). This element of outcome-based contracting lowered financial risk, lowered costs, and motivated both parties to look for further savings. Conversely, value auditing was discussed little by maintenance staff. Purchasing managers were interested in value auditing, but just as they put more emphasis on supplier resources as discussed in the previous section, they tended to regard value auditing as the supplier's job.

We further explored the impact of solution ownership by comparing the centrality of value auditing by the supplier in maintenance roles (centrality=.04, SE=.02) versus other roles (centrality=.09, SE=.02). The difference is only significant at the 10% level (t=-1.81, p=.079); if indeed present, it appears to be a medium effect (*d*=.60). Similarly, centrality of value auditing by the customer is lower for maintenance managers (centrality=.04, SE=.01) than for other roles (centrality=.11, SE=.02; t=-3.57, p=.001, a large effect: *d*=1.19). Hence:

> **Proposition 9:** Solution ownership moderates (enhances) the relationship between value-in-use auditing quality (by both the supplier and the customer) and collective value-in-use.

Reconfiguration capability

We also examined the data for differences across customer firms. One difference related to reconfiguration capability, which we define as the customer firm's ability to amend its processes in order to optimize value-in-use from the solution. A striking difference in PrintCo, irrespective of job role and supplier firm, was the presence in many ladders of customer resources playing a negative role. Interviewees regarded this state-owned company as having an structural inertia (Hannan and Freeman, 1984), with outdated, inflexible processes. In the view of an operations manager (P2): "[Ours is] such an archaic system, you've got no visibility with it. Fundamentally [supplier] are in here because the material function in [our company] failed" (P2-4). To some extent, resource integration decisions could take account of this inflexibility, outsourcing such processes as stock control to a supplier as part of the solution design. However, in other respects, the difficulty of reconfiguring the customer organization's processes provided a barrier to the realization of value-in-use. For example, outsourcing of some parts purchasing to a competent supplier held the potential to reduce costs, but had been halted due to the inflexibility of PrintCo's signoff processes: "Pete [supplier representative] has been looking to drive down the cost of each vendor…[Supplier] did start to order, but then a stop was put to it by [PrintCo]…I think to the older people, they don't like having things taken off them…You've always got that comfort zone in the Civil Service and you can't get sacked" (P2-39). As solutions dig deeply into the customer organization, this difficulty in reconfiguring the organization provided a barrier to the realization of value-in-use through an innovative solution.

While similar issues certainly came up in other firms, they appeared particularly prominent with PrintCo. The relative prominence of customer resource quality in PrintCo interviews is graphically illustrated in Figure 4 (4e vs. 4f). Customer resource quality is more

central for those in PrintCo than the other three companies (centrality=.26, SE=.05, vs centrality=.15, SE=.02; t=2.28, p=.03, a large effect: *d*=.84). We therefore propose:

> **Proposition 10:** A customer firm's reconfiguration capability moderates (reduces) the relationship between customer resource quality and: a) resource integration process quality; b) value-in-use (collective and individual).

Conclusions

This study aimed to explore how business customers assess solution quality as antecedent to value, and what constitutes the value-in-use that results from the solution. Figure 3 presents the resulting framework. In assessing solution quality, customers evaluate not just the quality of supplier resources, but the quality of their own resources and of the joint resource integration process. They also judge the quality of the value-in-use auditing of both parties (see all constructs listed in Table 4). These contribute to value-in-use at both collective and individual levels, judged through the constructs of Table 5. Laddering surfaces the central role of the resource integration process that draws on resources from both parties and in turn is central to value creation: see Figure 2. We identify moderators of the relationship between solution quality and value-in-use (Figure 3b).

These findings make three main contributions to literature on solutions and, more broadly, on quality and value. The first is the conception of solution quality and elicitation of its components, which critically include quality assessments of *both* parties' resources and processes, and not just those of the supplier. This contrasts with the overwhelming focus in quality research on the quality of the supplier's offerings alone (Bolton and Drew 1991; Sivakumar, Li, and Dong 2014; Ulaga and Eggert 2006). While both conceptual (Vargo and Lusch 2004) and empirical (Macdonald et al. 2011) work on co-creation acknowledges the role of the customer's usage process, our data show that in a solutions context the customer's role is not simply to *use* the supplier's offering; rather, the very nature of the solution is jointly designed and evolved through the joint resource integration process, which

importantly is itself quality-assessed by the customer. Innovation occurs as this process draws on both supplier and customer resource assessments to redefine the boundary between supplier and customer. An example is in the quality assessment of both the supplier's and the customer's sourcing network competence; where the supplier's network is perceived to be superior to the customer's, the customer may configure their supply network to make more use of the supplier as an intermediary. Hence, our data suggest that a solution's value proposition is itself co-created through the resource integration process. Furthermore, this value proposition is not simply delivered; rollout of the solution does not just involve meeting pre-defined goals. Rather, value-in-use is itself managed, redefined and optimized throughout the value auditing processes of both the supplier and the customer. These processes are sufficiently critical that they themselves are quality-assessed.

Overall, then, our data paint a radically different view of quality from the traditional view of the supplier's product and service quality alone. Most fundamentally, both practitioners and scholars seem to have a blind spot, looking for quality in the wrong place: it resides not purely in the supplier's actions at the customer interface, but also in the customer's own resources and processes, as well as in the supplier-customer relationship through quality assessment of the resource integration process. Golder, Mitra, and Moorman (2012) observe that customer co-production can impact on the quality of the supplier's offering, which in turn can impact on the customer's experience of and evaluation of the offering; for example, self-assembling furniture may impact on the quality of the assembled item. We add that co-production processes themselves are quality-assessed by the customer.

Our second contribution is the grounded elicitation of what constitutes the value-in-use that results from solution quality. Again, the picture that emerges is very different from the extant view. Whereas business literature overwhelmingly assumes value to be a function of the firm's collective goals, we find that business solutions are also judged relative to the

individual goals of usage center members. While this may prove true for a broader range of business offerings, it is perhaps particularly the case for product-service solutions, where the redefinition of organizational boundaries within the resource integration process makes profound changes to the working lives of customer staff. The extent to which these changes are positively perceived by individuals is instrumental in how the solution is judged. Equally, some dimensions of collective value-in-use are emergent and to some extent tacit rather than formally specified in advance: process improvement, dependence avoidance, and the impact on the customer's competitive advantage and innovativeness.

Our third contribution is in uncovering heterogeneity in how solutions are judged. While work on heterogeneity in the quality-value relationship is rare, it has received some attention in consumer markets (Overby et al. 2004). We add to this by identifying moderators in the solution context: resource integration involvement, role extraversion, solution ownership, and reconfiguration capability. We thereby contribute to the interest in service literature on how value depends on context (Vargo and Lusch 2016; Edvardsson, Tronvoll, and Gruber 2011).

Collectively, these findings suggest a very different view of solutions from that in the existing literature. Current definitions emphasize that solutions a) integrate products and services; b) are customized by the supplier; c) exist to solve a customer (organizational) problem; and d) achieve better (organizational) outcomes than the sum of the individual product and service components (Nordin and Kowalkowski 2010; Shankar, Berry, and Dotzel 2009; Storbacka 2011; Tuli, Kohli, and Bharadwaj, 2007). We add that solutions d) also integrate customer resources and processes; e) are customized through a joint resource integration process; f) are judged in terms of individual as well as organizational value-in-use; and g) are continually optimized to meet emergent goals. We accordingly propose a revised definition of business solutions as: *The combining of supplier and customer processes and resources through a joint resource integration process to create collective and individual*

value-in-use, which is monitored and optimized through value auditing processes.

Implications for Practice

Our findings shed light on how manufacturers can succeed in shifting towards solutions. Our field conversations with manufacturers suggest that some regard a solution primarily as a pricing tactic to increase margins through bundling of products and services. However, as Figure 3 shows, an additional range of skills is needed to provide high-quality solutions. Most critically, the supplier needs to work with the customer to create an effective resource integration process which combines the resources of both. This process requires a range of asset management decisions to be made between the customer and supplier, answering questions such as (in this maintenance and operations context) where to hold stock, who will maintain what equipment, who is best placed to purchase equipment, and who can best develop predictive maintenance systems. The answer should be contingent on the quality of the resources that each party brings to bear. For example, a supplier to both DeviceCo and HealthCo applied the same approach with each, taking over the sourcing of some parts from the customer as part of the solution. However, while the supplier's sourcing network competence in the devices sector was considerable, regulatory differences in the health sector meant that this aspect of the solution did not work well. The resource integration process, then, is integral to the joint development of the value proposition, not subsequent to it.

In the above example, resource integration redefined the boundary between supplier and customer; this is not uncommon. For example, Finland's Neste Oil achieved a price premium with shipping operator Tallink by taking over the customer's oil stocks and switching oil storage from trucks to a ship, reducing overall cost. The supplier also took over some financial hedging as it could achieve better market rates (Neste Corporation 2016). Such boundary shifting carries risks as well as benefits for the supplier. In order to gain greater access to service profit pools, for example, Rolls-Royce's TotalCare solution makes long-

term service pricing commitments for which the firm carries risk. Over-optimistic pricing of some of these contracts has given the company financial problems years later. Taking risk away from the customer only makes sense if the supplier can reduce that risk, estimate it, mitigate it, and price for it. A compromise we saw on several occasions in our data was to contract on value-in-use for only part of the contract. Another example of this is DHL's solution for a train operator, where the provision of food and drink logistics to station and train buffets was contracted at around cost, with additional payments dependent on the travelling consumer's satisfaction with the buffet, which was staffed by the train operator. Neither party could achieve this value-in-use on their own, but this element of outcome-based contracting aligned their interests in achieving successful resource integration without exposing either to excessive risk.

Making this resource integration process work requires high coordination effectiveness—again, a quality of the dyad rather than of the supplier. Our data suggest that what works well here is integrated teams, typically involving supplier personnel working permanently on site at the customer's premises. DHL's successful Customer4Life initiative takes this integration logic further than most: its account plans for its key accounts are written not by account managers but by a joint team with the customer, and they are distributed in both firms.

To make resource integration work, the employee competence and customer orientation required of supplier staff is critical. More broadly, the resource integration process can only improve on the prior situation if the supplier brings to bear some superior resources. Importantly, these go beyond the ability to serve competently (the traditional notion of service quality) to emphasize an ability to improve the *customer's* processes. Solutions providers hence need to redesign not only their own offerings but also their customer's processes, to optimize not product quality but value-in-use. For example, Neste helped Tallink refit its engines to use more efficient and environmentally friendly oil, lowering the

shipping firm's total journey cost as well as its environmental objectives.

This reconfiguration of customer processes can lead to resistances within the customer firm as its employees may fear losing influence or even their jobs, or because they just want to avoid any changes within their job roles. This leads to the necessity to jointly design at an early stage adequate change management strategies in order to overcome such conflicts and capture the overall success of a solution. Another potential challenge to be borne in mind when altering customer processes to improve solution quality is that these changes may disrupt the solution quality for the customer and other suppliers. For example, UK telecommunications firm BT provided its CRM system to its key distributors to help them share a single customer view on the end customer's relationship with BT. While helping the distributor to sell and service BT products, this added complexity for the distributor in navigating between BT's system and its own database for other equipment suppliers.

The combining of joint processes and resources raises the issue of quality control. In a preferred solution, both the supplier and the customer are engaged in quality control, and their chief focus is not on what the supplier delivers but on the value-in-use jointly created. Developing an effective value-in-use auditing process should therefore be a high priority for solutions providers. This process needs to monitor the value-in-use created by the solution, including emergent benefits such as unanticipated innovations or improved competitive advantage; the value-in-use typology of Table 5 forms a checklist as to where these benefits may lie, though others are possible. The auditing process also needs to *optimize* that value-in-use, continuously looking for ways to increase valued outcomes, irrespective of whether they form part of the contract or not. What seems to work best is for this process to be tautly coupled with the customer's auditing efforts, giving the partnership's joint findings credibility with senior management. For example, DHL holds quarterly reviews in which benefits and problems for both parties are openly shared and tracked, and further value

creating opportunities are brainstormed. Reflecting the symmetry between customer and supplier in our conceptual framework, these meetings are noticeably open, with both parties declaring their satisfaction with the other and listing ways in which the other could improve. This value-in-use auditing should be a key focus of account managers, given its importance both in generating and signaling beneficial outcomes within the customer firm. Perhaps solutions providers should rebrand quality control as value control.

When renewal decisions approach, account managers will also wish to be aware of the distinct emphases of different members of the usage group revealed by our moderator analysis. Hands-on employees (such as operations and maintenance staff) who are deeply involved in resource integration focus more than others on individual value-in-use dimensions such as task simplicity. Account managers may need to take account of these individual motivations despite their absence from the formal outputs of the customer's value-in-use auditing processes. In addition, employees such as purchasing managers who spend more time dealing with suppliers (which we term role extraversion) are likely to be less concerned than others with the quality of customer resources. And finally, roles with low responsibility for the solution's commercial success (such as maintenance managers) place less emphasis on value-in-use auditing than others. Conversations with customers will need tailoring to these different interests.

Many of these conversations around individual value-in-use, however, cannot easily be undertaken by marketing or sales people; it is service and operations staff involved in the various processes of resource integration who are in a position to optimize such value. This leads to the necessity of an integrated communications strategy, so that all supplier activities in the customer journey aim at increasing quality and value perceptions. Again, this points to a broader role for key account managers, who need to manage contacts with purchasing and general managers, but also to coordinate wider communication activities with the customer.

A final management implication relates to market research. We have commented that the picture of solution quality emerging from our data is radically different from the literature's extant view of product and service quality; it is equally different from the implicit view embedded in most firms' customer insight processes. Suppliers' satisfaction surveys and interviews commonly focus purely on capturing the customer's view of the *supplier's* products and services, and in particular on moments of service delivery. While important, these moments only form part of the solution; equally important in value creation are the customer's assessment of the quality of their own resources as well as of the joint resource integration process. Suppliers need to expand the scope of their customer insight substantially in order to uncover these perceptions. Furthermore, this insight should go beyond quality to incorporate value-in-use perceptions. Unlike the customer's value auditing process which focuses purely on collective value, suppliers may wish to include individual value-in-use in such market research. Such qualitative techniques as open interviews or, ideally, participant or non-participant observation could be used to check and, if necessary, extend the set of individual value-in-use constructs we have identified in further contexts. Surveys could then track the extent to which the solution is creating or destroying individual value-in-use, through items for each construct. Where feasible, survey research needs to avoid the trap of a single purchasing respondent, but rather include multiple job roles across the usage group.

Research Directions

One important research direction is to conduct quantitative research exploring the antecedents and outcomes of solution quality and value-in-use. This could usefully check the proposition that value-in-use mediates the relationship between solution quality and overall satisfaction (Yang and Peterson 2004). The many other issues requiring examination include how customers trade off or otherwise combine value-in-use constructs in determining satisfaction and purchase behaviors; how value-in-use perceptions of individuals impact on collective

decision-making about supplier choice; and whether value-in-use is judged absolutely or relative to expectations at the moment of purchase. The relative role of collective value-in-use constructs versus individual ones in determining behavioral outcomes forms a particularly interesting research direction. Research is also needed into whether, in customers' decisions on supplier choice, they distinguish between value-in-use failures that arise from supplier processes versus those that arise from their own customer processes or the joint resource integration process. These questions ideally require data combining quality and value-in-use perceptions with behaviors, if possible using longitudinal approaches. Longitudinal data might also aid in exploration of the dynamics of value-in-use, extending work on the dynamics of service quality (Sivakumar, Li, and Dong 2014). Our literature review summarized in Table 1 suggests that all these research questions are just as relevant in consumer markets as in business relationships.

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Table 1: Empirical Studies of Customer Value in Business-to-Consumer and Business-to-Business Contexts

Authors	Definition (or operationalization) of quality	Definition of value	Quality perceptions		Value appraisals			Sample		
			Supplier process	Customer process	Multidim-ensional [1]	Individ-ual	Collect-ive	Buyer	User	Multiple [2]
Business-to-consumer contexts										
Zeithaml 1988	The consumer's judgement about a product's overall excellence or superiority	The consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given	Yes	--	--	Yes	--	--	Yes	--
Bolton & Drew 1991	The customer's assessment of the overall excellence or superiority of a service	Trade-off between a customer's evaluation of the benefits of using a service and its cost	Yes	--	--	Yes	--	--	Yes	--
Keeney 1999	--	Net value of the benefits and cost of both a product and the processes of finding, ordering, and receiving it	Yes	--	--	Yes	--	Yes	--	--
Sweeney et al. 1999	Not defined. Measured dimensions of quality include functional service quality, technical service quality and product quality.	Perceived value for money. The customer's assessment of net valence resulting from positive valences (perceived return) and negative valences (perceived risk)	Yes	--	--	Yes	--	Yes	--	--
Cronin et al. 2000	Implicit definition: service performance perception	Overall assessment of utility of a product based on perceptions of what is received and what is given	Yes	--	--	Yes	--		Yes	--
Sweeney & Soutar 2001	Implicit definition: perceived product and service excellence or superiority	Implicit definition: product quality relative to price	Yes	--	--	Yes	--	Yes	--	--
Mathwick et al. 2001	Affordable quality, or economic utility, plus exchange encounter efficiency comprise consumer return on investment	Experiential value is a multidimensional construct comprising four dimensions (consumer return on investment, service excellence, playfulness, and aesthetic appeal)	Yes	--	Yes	Yes	--	Yes	Yes	--
Sirdeshmukh et al. 2002	Not explicitly included. Drivers of value studied close to the quality concept: operational competence, operational benevolence, and problem-solving orientation	The consumer's perception of the benefits minus the costs of maintaining an ongoing relationship with a service provider.	Yes	--	--	Yes	--	--	Yes	--
Yang & Peterson 2004	Not explicitly included. Satisfaction measure includes perceived service performance and ease of use	The ratio of the consumer's outcome/input to that of the service provider's outcome/input	Yes	--	--	Yes	--	--	Yes	--
Business-to-business contexts										
Walter et al. 2001	--	Supplier perceived value: trade-off between benefits and sacrifices gained through a customer relationship	Yes	--	--	--	Yes	--[3]	--	--
Desarbo et al. 2001	The consumer's judgement about a product's overall excellence or superiority (after Zeithaml 1988)	Perceived value is a function of perceived quality and perceived price	Yes	--	--	--	Yes	--	Yes	--
Ulaga 2003	Product quality is the extent to which the supplier's product meets the customer's specifications. Key aspects are performance, reliability and consistency over time.	The trade-off between the benefits (''what you get'') and the sacrifices (''what you give'') in a market exchange	Yes	--	Yes	--	Yes	Yes	--	--
Lam et al. 2004	Not defined. Items to measure service quality include ease, timeliness, reliability, and, understanding needs.	A comparison of weighted "get" attributes to "give" attributes	Yes	--	--	--	Yes	Yes	Yes	--
Ulaga & Eggert 2006	Product quality is the extent to which the supplier's product meets the customer's specifications. Key aspects are performance, reliability and consistency over time.	Benefits and costs	Yes	--	--	--	Yes	Yes	--	--
Faroughian et al. 2012	Not defined. Measured dimensions of e-service quality include efficiency, fulfilment, availability and security.	Benefits and sacrifices (which vary independently)	Yes	--	Yes	--	Yes	Yes	--	--
Aarikka-Stenroos & Jaakkola 2012	Implicit definition: the performance of offering and interaction	The trade-off between the benefits and sacrifices as perceived by the customer; emerge through the customer's value generating processes	--	--	Yes	--	Yes	Yes	Yes	--
This paper	*The perceived excellence or superiority of an entity, in this case a solution*	*All customer perceived consequences arising from a solution that facilitate or hinder achieving the customer's goals*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

1. Applies summative assessment of value unless listed as multidimensional. 2. Interviews with a single company/household informant, unless listed as multiple. 3. Sample included sellers not buyers/users

Table 2: Sample

Case	Role				
	Maintenance	**Operations**	**Purchasing**	**General Management**	**Total interviews**
BuildCo					
Number interviewees	6	1	1	1	9
Interviewee IDs	B3, B4, B6, B7, B8, B9	B5	B2	B1	
DeviceCo					
Number interviewees	4	3	1	1	9
Interviewee IDs	D5, D7, D8, D9	D1, D3, D6	D4	D2	
PrintCo					
Number interviewees	3	3	1	1	8
Interviewee IDs	P4, P5, P7	P2, P3, P6	P8	P1	
HealthCo					
Number interviewees	5	2	1	2	10
Interviewee IDs	H1, H2, H4, H5, H7	H6, H11	H9	H3, H10	
Total	18	9	4	5	36

Interviewee IDs are unique to each interviewee and appear as the first part of the label in each quotation that appears in this paper.

Table 3: Method for Eliciting Quality and Value-in-Use

For each step, instructions synthesized from the literature are followed by indented text giving specific details for this study.

Data collection: Repertory grid interviews with means-end chaining	
1	**Element elicitation:** Elicit elements (supplier firms) for the repertory grid analysis Each interviewee was asked to name six solutions providers ('elements' in repertory grid terminology) with which they are familiar. Each supplier name was written onto a small piece of paper for use in the interview.
2	**Construct elicitation:** Elicit constructs using the triadic method (Kelly 1963). Interviewer presents three elements at a time and asks: "In what way are two of these similar to each other and different from the third?" The interviewee presented three supplier names and asked: "In what way are two of these similar to each other and different from the third in terms of the outcomes you get?" The resulting discussion led to elicitation of dyadic constructs that the interviewer wrote on a form called a repertory grid, illustrated in Figure 1. Each construct has a construct pole (e.g. "commercial benefit") and a contrast pole (e.g. "not commercial benefit").
3	**Element rating:** Rate elements on bipolar constructs (Goffin and Koners 2011). The interviewee was then asked to rate all six suppliers on each construct, using a 5-point Likert scale. These ratings were recorded on the grid. The interviewee's talk while completing this task further illuminated construct meaning.
4	**Laddering to higher order constructs:** The higher, more abstract levels of a goal hierarchy tend to be more tacit than the lower, more concrete levels (Peterman 1997; Woodruff 1997). Hence, laddering questions using a means-end chaining approach (Gutman 1982) are needed to elicit the higher order value constructs (Barsalou 1991; Zeithaml 1988). Value-in-use is more abstract and tacit than the more concrete construct of quality. This meant that that the "outcomes you get" question was likely to elicit quality constructs, rather than value-in-use ones, despite the careful wording. The interviewer used laddering questions to elicit the value-in-use constructs corresponding to each solution quality construct. Laddering questions include: 'Why do you care about that?', 'Why is that important to you?', and 'How does that make you feel?' This resulted in 'ladders' such as that illustrated in the lower part of Figure 1.
5	**Repeated construct elicitation:** Repeat steps 2 - 4 for further triads of elements to elicit additional constructs. After completing the discussion around the first triad of supplier names, the interviewer then presented another triad and repeated the "outcomes you get" question, while asking the interviewee not to repeat a construct that had already been given. In Figure 1, for example, the interviewee identified "focused on our organization's needs" as a result of viewing the second triad. Steps 2-4 were repeated until no further constructs were elicited. In the example grid in Figure 1, six constructs were elicited.
Analysis Stage 1: Construct categorization	
6	**Raw construct identification:** Interviews are transcribed. Analysis of transcripts follows the method of Goffin, Lemke, and Szwejczewski (2006) where raw constructs are transferred onto numbered cards. Interviews were transcribed into 875 pages of text. The researchers reviewed each transcript identifying chunks of meaning relating to evaluation of the solution and transferring each raw construct onto a separate card.
7	**Initial construct categorization:** The chunks of meaning from the first case are categorized. Cards from the first customer firm were used to develop an initial construct categorization. In a series of workshops, three researchers sorted the cards into common themes or standardized constructs. For example, interviewees talked about the supplier's sourcing network competence in such differing language as "sourcing ability", "negotiation skills with next tier supplier", "ability to cross-trade" and "back-up network"; the researchers grouped these and identified and defined a standardized construct name "sourcing network competence".
8	**Construct definition:** The process of naming and defining constructs follows the approach of Gioia, Corley and Hamilton (2012) in which literature is examined to establish where an existing term accurately represents the data. The literature was examined to identify where an existing term matches the data (e.g. customer orientation); otherwise, an appropriate term was derived from the data (e.g. value-in-use monitoring). The researchers further grouped constructs into entities of evaluation, shown in bold in column 1 of Tables 4 and 5, as follows. Solution quality constructs (Table 4) were examined to determine the object of the evaluation, such as a supplier process or a supplier resource. For example, sourcing network competence was coded as an evaluation of supplier resources. Value-in-use constructs (Table 5) were examined to consider whether they related to goals of the individual or to collective goals of the organization.

9 **Standardized construct validation:** Independent judges are asked to check constructs and definitions followed by a calculation of the proportional reduction in loss (PRL; Rust and Cooil 1994). PRL is calculated from a comparison of the independent judges' categorizations with each other and with the authors' categorization. Rust and Cooil's (1994) recommended cut-off is .7.

Two independent scholars were asked to allocate raw construct cards from the first customer firm to a list of standardized construct names and definitions. The PRL statistic for value-in-use cards was .82, well above the cut-off of .7, so the value-in-use categorization was accepted and is reported in Table 5. The solution quality categorization resulted in a somewhat lower PRL of .75; although above the .7 level, we decided to review the categorization. Three primary researchers agreed on amendments to construct definitions and to the allocation of cards to constructs, in order to remove ambiguities. The inter-coder reliability check was repeated with two further independent scholars, resulting in a revised PRL statistic for solution quality of .80. The resulting categorization is reported in Table 4. As a further reliability check, two further independent scholars sorted the combined card set into solution quality and value-in-use; this resulted in a PRL statistic of .85.

10 **Further construct identification and categorization:** Constructs are identified and categorized from remaining cases, allowing for the possibility of new constructs emerging or existing constructs requiring redefinition.

In further workshops involving the three primary researchers, cards from the remaining three customer firms were allocated to the standardized constructs. Only one new construct emerged, process improvement, during analysis of the second case; the researchers agreed this new construct's definition and allocation of cards to it.

Analysis Stage 2: Means-end chain analysis

11 **Ladder identification:** Having classified raw constructs into a limited number of standardized constructs, the next step is to record ladders of constructs from the transcripts, through examination of the sequence of cards and their adjoining text (Reynolds and Gutman 1988).

From the 36 interviews, the researchers identified 609 ladders with an average of 17 ladders per interview (range 10 to 26). Means-ends chain research often uses a three-level a priori classification of constructs into attributes, consequences and values; by contrast, we have an a priori classification into two levels, quality and value-in-use. We allowed the data to dictate that two or more quality constructs or two value-in-use constructs might appear in the same ladder. Hence each ladder comprised one or more quality constructs and one or more value-in-use constructs, the average ladder length being 2.67.

12 **Implications matrix tabulation:** Links between constructs in a ladder, known as implications, are tabulated in an implications matrix (Reynolds and Gutman 1988). Links in a ladder can be direct (where one construct is adjacent to another) or indirect (where two constructs are in the same ladder but not adjacent).

An implications matrix was drawn up including all direct and indirect implications between 13 quality constructs and 15 value constructs (see Web Appendix). This was summarized in a 7x7 implications matrix (Table 6) including the five entities of quality evaluation and two entities of value-in-use evaluation. Each non-empty cell shows the number of times a row construct is followed by a column construct within ladders.

13 **Index calculation:** Indices summarizing the importance and role of constructs are calculated from the implications matrix following Pieters, Baumgartner, and Allen (1995): abstractness is the average level of a construct in the ladder from concrete (approaching 0) to abstract (approaching 1); centrality measures how often a construct appears in a ladder; and prestige is an index of how often a construct is the destination in implications, as a proportion of all implications in the matrix.

These indices are reported in Table 6. Each index ranges from 0 (low) to 1 (high).

14 **Hierarchical value map visualization:** The implications matrix that emerges from means-end chaining is visualized in a hierarchical value map. Decisions need to be made about 'cut-off' levels for the number of implications below which no line between constructs will be depicted on the map; this is a balance between completeness and parsimony in much the same way as in multidimensional scaling (Reynolds and Gutman 1988, Gengler and Reynolds 1995). Another decision is whether to include indirect implications (where A links to B but via C) or only direct ones.

We use direct implications only for ease of interpretability. Our cut-off was a cell that contains less than 1% of all implications in the matrix. In Figure 2, the horizontal axis represents the construct's abstractness (0 to 1); the circle area is proportional to construct centrality; and the line thickness is proportional to the number of implications between two constructs. We similarly drew up maps for sub-samples in Figure 4.

15 **Goodness of fit and parsimony calculation:** To check how well the hierarchical value map fits the data, it is useful to calculate goodness of fit, the percentage of implications that are represented in the map, and how parsimoniously this is achieved (Pieters, Baumgartner, and Allen 1995).

The map in Figure 2 resulted in 89% of implications being represented in the map goodness of fit (GF) measure, and was achieved parsimoniously through 33% of all cells in the implications matrix (Pa1) and 44% of non-zero cells (Pa2) being represented in the map. See Figure 4 for equivalents for sub-samples by job role and sector.

Table 4: Solution Quality Constructs

Entity of evaluation	Definition	Illustrative quotation(s)	Number of individuals[1]									% individuals
			Role				Company					
			Ma	Op	Pu	GM	Dco	Hco	Bco	Pco	Tot	
			18	*9*	*4*	*5*	*9*	*10*	*9*	*8*	*36*	
Supplier resources												
Organizational competences	Supplier's organizational capabilities relating to processes, knowledge and physical assets contributing to customer benefits	"they'd machine it for you and make up the parts for you to try it out" (H2-15) "so their manuals are very good" (H2-19)	**17**	**7**	**4**	**4**	**8**	**9**	**8**	**7**	**32**	**89**
Employee competence	Availability, skills and professionalism of supplier personnel contributing to customer benefits	"there's one man and he does it all and he does a wonderful job" (D4-24)	**13**	**6**	**4**	**4**	**7**	**8**	**8**	**4**	**27**	**75**
Customer orientation	Attitudes and practices of supplier's personnel relating to understanding, prioritizing and proactively satisfying individual customer needs	"Yes they would, amazingly enough, these guys are a long time in the trade and they would know what people require and need" (H6-4)	**11**	**7**	**4**	**4**	**6**	**7**	**8**	**5**	**26**	**72**
Sourcing network competence	Capabilities of supplier's organization and personnel to leverage their knowledge of and relationships with other firms for the benefit of the customer	"Where [supplier] would add huge benefit is that they would continue to manage all your suppliers, you know, they could handle all your suppliers on your behalf" (D2-26) "[Supplier representative] would make suggestions – we have a particular component and he could pick up a component like for like but maybe a different brand, that they could buy cheaper than we could" (H10-22)	**12**	**6**	**2**	**5**	**7**	**7**	**6**	**5**	**25**	**69**
Customer resources												
Organizational competences	Customer's organizational capabilities relating to processes, knowledge and physical assets contributing to customer benefits	"this plant was miles behind what I felt was maintenance best practice. And again inventory was a big issue in that we didn't have an inventory store, we didn't really understand the value of the inventory we were holding, we had no systems" (H10-1)	**11**	**7**	**4**	**5**	**3**	**10**	**6**	**8**	**27**	**75**
Employee competence	Availability, skills and professionalism of customer personnel contributing to customer benefits	"because we do have our own skill set, we apply a full time reliability engineer" (H10-1)	**11**	**4**	**3**	**4**	**4**	**9**	**5**	**4**	**22**	**61**
Sourcing network competence	Capabilities of customer's organization and personnel to leverage their knowledge of and relationships with other firms for the benefit of the customer	"before [contracting an outsourced maintenance supplier] we had no traceability of saying that the motors were bought [from any particular supplier]; we had no proof or documentation, so you couldn't send it back to be done again"(D9-13)	**11**	**5**	**2**	**4**	**7**	**6**	**5**	**4**	**22**	**61**

Resource integration												
Coordination effectiveness	The extent to which the processes of supplier-customer interaction act to integrate resources for the benefit of the customer	"We wouldn't see these people routinely on site at all, we might see them once a year possibly less. …As needed, yes. [Supplier] are here every month" (H5-13) "they were very proactive in coming back with suggestions as well which, to be fair to them, we've implemented, most of them. And there's been no deterioration in service to the staff" (D2-58)	**18**	**9**	**4**	**5**	**9**	**10**	**9**	**8**	**36**	**100**
Asset management effectiveness	The extent to which the resource integration processes fulfil the tasks of purchasing, maintaining, using and disposing of physical assets for the benefit of the customer	"they are difficult to negotiate with, because they know that I suppose our hands are tied because of the fact that we're pharmaceutical. They know the autoclaves on our filling lines that we would need their parts, so it's difficult to negotiate pricing with them" (H3-28)	**14**	**5**	**4**	**5**	**8**	**8**	**7**	**5**	**27**	**75**
Value-in-use auditing by the supplier												
Value-in-use monitoring	All supplier activities of identifying and reporting the value-in-use resulting from the solution	"Yes, they're [monitoring] hard and soft savings for the month or the quarter and [they provide] the tracker of stock lines and total value of stock giving us a guide, a trend really" (P7-10)	**4**	**5**	**3**	**5**	**5**	**4**	**3**	**5**	**17**	**47**
Value-in-use optimizing	All supplier activities of reflecting on and disseminating opportunities for value-in-use enhancement	"These guys have monthly management reviews that I attend… they present to me on a monthly basis in terms of the cost options and they …ask for feedback from me in terms of where I want them to go. … They've been seen to be very proactive in terms of managing me as their customer" (D2-44)	**2**	**2**	**2**	**3**	**2**	**4**	**1**	**2**	**9**	**25**
Value-in-use auditing by the customer												
Value-in-use monitoring	All customer activities of identifying and reporting the value-in-use resulting from the solution	"I think the one area we may not be as good as we'd like to be is reporting back to [ourselves] on how the performance is going, how we're doing." (P8-40)	**9**	**5**	**4**	**5**	**5**	**7**	**5**	**6**	**23**	**64**
Value-in-use optimizing	All customer activities of reflecting on and disseminating opportunities for value-in-use enhancement	"so that's the discussions that are going on right now is, let's move the contract from a simple implementation to 'What are our KPI's?', 'What is it we really want from this?', and set what we want and then see that there's a plan that underpins it to deliver that" (H9-5)	**4**	**3**	**1**	**3**	**2**	**3**	**4**	**2**	**11**	**31**

1. Ma=Maintenance, Op=Operations, Pu=Purchasing, GM=General Management / Factory Management, Dco=DeviceCo, Hco=HealthCo, Bco=BuildCo, Pco=Printco, Tot=total individuals.

Table 5: Value-in-Use Constructs

Entity of evaluation	Definition	Illustrative quotation(s)	Number of individuals[1]									% individuals
			Role				Company					
			Ma	Op	Pu	GM	Dco	Hco	Bco	Pco	Tot	
			18	*9*	*4*	*5*	*9*	*10*	*9*	*8*	*36*	
Collective value-in-use												
Fast problem solving	Rapid resolution of operational difficulties	"it took a while for things to fall into place. But now they're a lot happier because when they look for something it's there" (H11-7) "I would have heard a lot, you know, the line is down because there was a part missing or there was stock out and that has reduced dramatically" (H3-10)	**18**	**8**	**3**	**5**	**9**	**9**	**9**	**7**	**34**	**94**
Low costs	Low operational costs from low purchase prices or other operational savings	"that is going to be better because they are there to source the parts cheaper and save the company money" (H1-47) "and I suppose [supplier representative]'s job, if I'm there shouting that it's urgent, he'll get the best value for money out there for me" (H5-39)	**16**	**7**	**3**	**5**	**9**	**9**	**7**	**6**	**31**	**86**
Process improvement	Simplification of or other enhancements to the customer's processes	"we're dealing less and less with vendors" (H1-10) "quite often I've had to chase things" (P4-8)	**11**	**9**	**3**	**4**	**7**	**7**	**7**	**6**	**27**	**75**
Avoiding downtime	Minimizing non-productive time in the firm's operations	"I said already in reducing our labor … they've freed up a lot of our technician's time and our … maintenance supervisor's time. Because now the guys don't have to be on the phone ordering parts, tracing it. That's probably the biggest area that they've added value" (H10-20)	**13**	**6**	**2**	**3**	**7**	**6**	**3**	**8**	**24**	**67**
Reduced financial risk	Minimized uncertainty with respect to financial liabilities	"so that we'd have a warranty of a repair which we didn't have before [supplier] took over" (P1-4)	**6**	**2**	**3**	**5**	**5**	**4**	**4**	**3**	**16**	**44**
Dependence avoidance	Minimized dependence on the supplier	"your suppliers being so entwined in your business. Because there's pluses and minuses to that, it can be extremely dangerous because you'll never be able to get them out" (D4-66)	**6**	**2**	**1**	**3**	**4**	**5**	**1**	**2**	**12**	**33**
Fixed capital reduction	Minimized use of the customer's fixed capital	"if I put them into boxes and no one sees them or are not able to retrieve them or they're put in the wrong place, it's pointless. If I can get a product within two days [but] it takes someone four days to find it, first of all you've got to establish what sort of inventory system you have and [get] your proper housekeeping done" (D5-22)	**5**	**3**	**2**	**2**	**6**	**4**	**0**	**2**	**12**	**33**

Innovativeness	Generation and use of ideas for business improvement	"I told [the supplier] if they seize any opportunity that they can add value to our business, even if we've got existing contracts in place, I've told them to come to us" (D1-79)	**1**	**5**	**2**	**3**	**3**	**3**	**3**	**2**	**11**	**31**
Competitive advantage	Impact on the firm's own market position	"it doesn't get the company moving as it should do" (B4-14) "[compared with another supplier] these two guys give us a competitive advantage" (D2-33)	**2**	**2**	**1**	**1**	**3**	**0**	**2**	**1**	**6**	**17**
Individual value-in-use												
Task simplicity	Simplicity and time efficiency of the processes comprising one's job	"It was chaos, really, but it's very organized now. I prefer it like this" (H2-8) "Well obviously … makes my job easier in the respect that I don't have to deal with any of these people, I just give it to [supplier] and that's it." (P4-13)	**16**	**7**	**3**	**3**	**5**	**7**	**9**	**8**	**29**	**81**
Perceived control	Perception of control over processes and resources comprising one's job	"there's always a minimum stock level there so you know when you go into stores that that part is going to be there, so that's good to know" (H1-38) [with this supplier] "I know where I am but if they come to me and it's something that I've sent out through [other supplier] I have no control" (P5-28)	**14**	**6**	**2**	**2**	**7**	**8**	**4**	**5**	**24**	**67**
Pressure reduction	Minimized pressure and stress in one's daily job	"they come on site and they make it easy for me" (H6-10) "it's just a big improvement for me and I'm not in stores stressed trying to find parts, I know where to find them now" (H1-57)	**12**	**7**	**2**	**3**	**6**	**7**	**5**	**6**	**24**	**67**
Uncertainty reduction	Minimized uncertainty related to processes and decisions comprising one's job	"they're telepathic, they know exactly what I need" (H6-3) "I would rather know it today than find out tomorrow if it is going to be three days. Now and again they want to please me and say yes, but that is actually worse than if they said 'no, sorry, I can't get it until Thursday'" (B3-27)	**11**	**5**	**2**	**1**	**5**	**4**	**5**	**5**	**19**	**53**
Social comfort	Feeling comfortable with other people at work	"we would have a really good relationship with him as well, so to me that's important" (H1-35) "it's nice to come into work and be relaxed with people when they come up to you rather than people that you don't trust" (D7-25))	**10**	**4**	**2**	**1**	**4**	**5**	**4**	**4**	**17**	**47**
Personal reputation	Being viewed as a person with high job competence	"Ultimately it will come back to me … it's muck in your face … from management insofar as 'why aren't you delivering what we require?'" (D3-25)	**7**	**3**	**0**	**0**	**4**	**2**	**2**	**2**	**10**	**28**

1. Ma=Maintenance, Op=Operations, Pu=Purchasing, GM=General Management / Factory Management, Dco=DeviceCo, Hco=HealthCo, Bco=BuildCo, Pco=Printco, Tot=total individuals.

Table 6:
Implications Matrix (Total Sample)

Construct	Entities of evaluation[1]														Total (number of implications)	Indices[2]		
	Solution quality constructs (number of implications)										Value-in-use constructs (number of implications)							
	Supplier resources (SR)		Customer resources (CR)		Resource integration (RI)		Value auditing by the supplier (VAS)		Value auditing by the customer (VAC)		Collective value-in-use (V-C)		Individual value-in-use (V-I)			Abstract-ness	Centrality	Prestige
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Direct	Direct	Direct
Supplier resources	24	25	9	9	73	78	3	4	5	6	110	223	51	115	272	.12	.31	.04
Customer resources	4	4	9	9	41	48	3	4	3	6	60	133	33	62	154	.14	.17	.02
Resource integration	10	10	4	4	13	13	8	8	5	6	172	266	107	146	327	.31	.45	.14
Value auditing by the supplier	1	1			5	6			8	8	32	46	7	9	52	.28	.07	.02
Value auditing by the customer			2	2	10	13	7	7	3	3	26	50	5	11	53	.31	.08	.02
Collective value-in-use											71	81	36	41	506	.83	.60	.50
Individual value-in-use											36	39	25	27	265	.81	.32	.26
Total															1629			

1. Each cell shows the number of times the row construct is followed by the column construct within a ladder, as the next step in the ladder ('direct' column) or at any point later in the ladder ('indirect' column). In means-end terminology, the indirect column therefore includes the sum of direct plus indirect implications.
2. Indices are calculated as follows: abstractness is the average level of a construct in the ladder from concrete (approaching 0) to abstract (approaching 1); centrality measures how often a construct appears in any ladder (ranging from 0 to 1); and prestige is an index of how often a construct is the destination in implications, as a proportion of all implications in the matrix (again ranging from 0 to 1).

Figure 1: Example of Repertory Grid and Laddering - Engineering Manager (D2), DeviceCo

Repertory Grid

#	Construct pole (1)	SUPPLIERS						Contrast pole (5)
		Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6	
1	Gives us purchasing power	4	2	2	3	1	2	No benefit to the prices we pay
2	Focused on our organization's needs	5	2	1	2	2	3	Not much focus on our organization
3	Tries to be seamless with us	3	2	2	2/3	2	1	Just delivers
4	Embedded	3	2	2	3/4	2	2	Replaceable
5	Motivated to reduce our costs	4	2	2	3	1	2	Accepts the status quo
6	Monthly or quarterly reviews	5	2	2	3	1	2	No regular reviews

Each row (numbered 1 to 6 in this example) represents a construct by which the interviewee assesses solution suppliers. Each of six suppliers named by the customer is rated from 1 to 5 on each construct, where 1 represents the "construct pole" (e.g., "Embedded") and 5 represents the "contrast pole" (e.g., "Replaceable").

Example Ladder

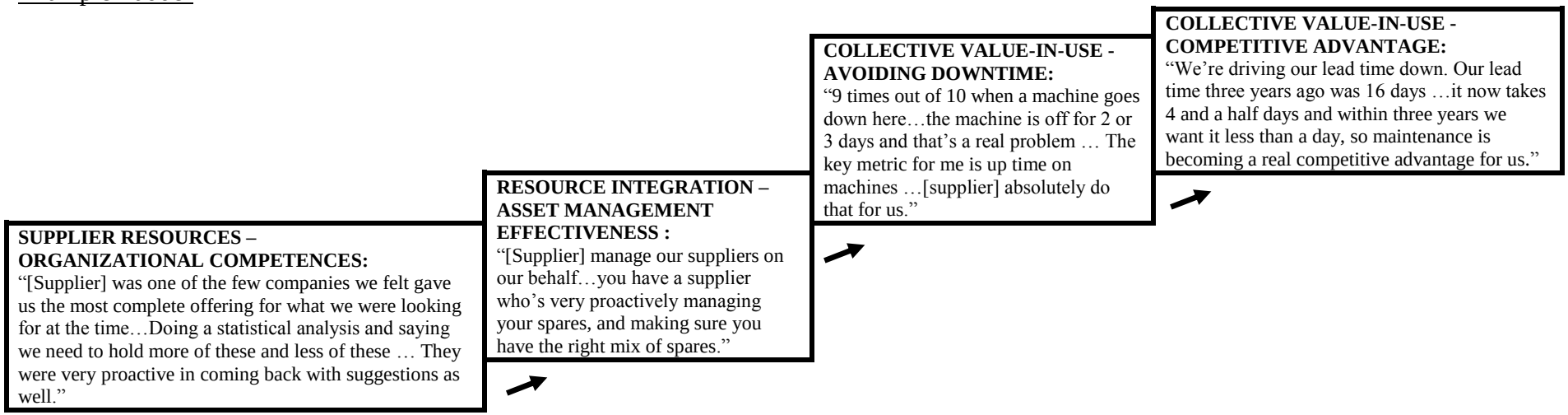
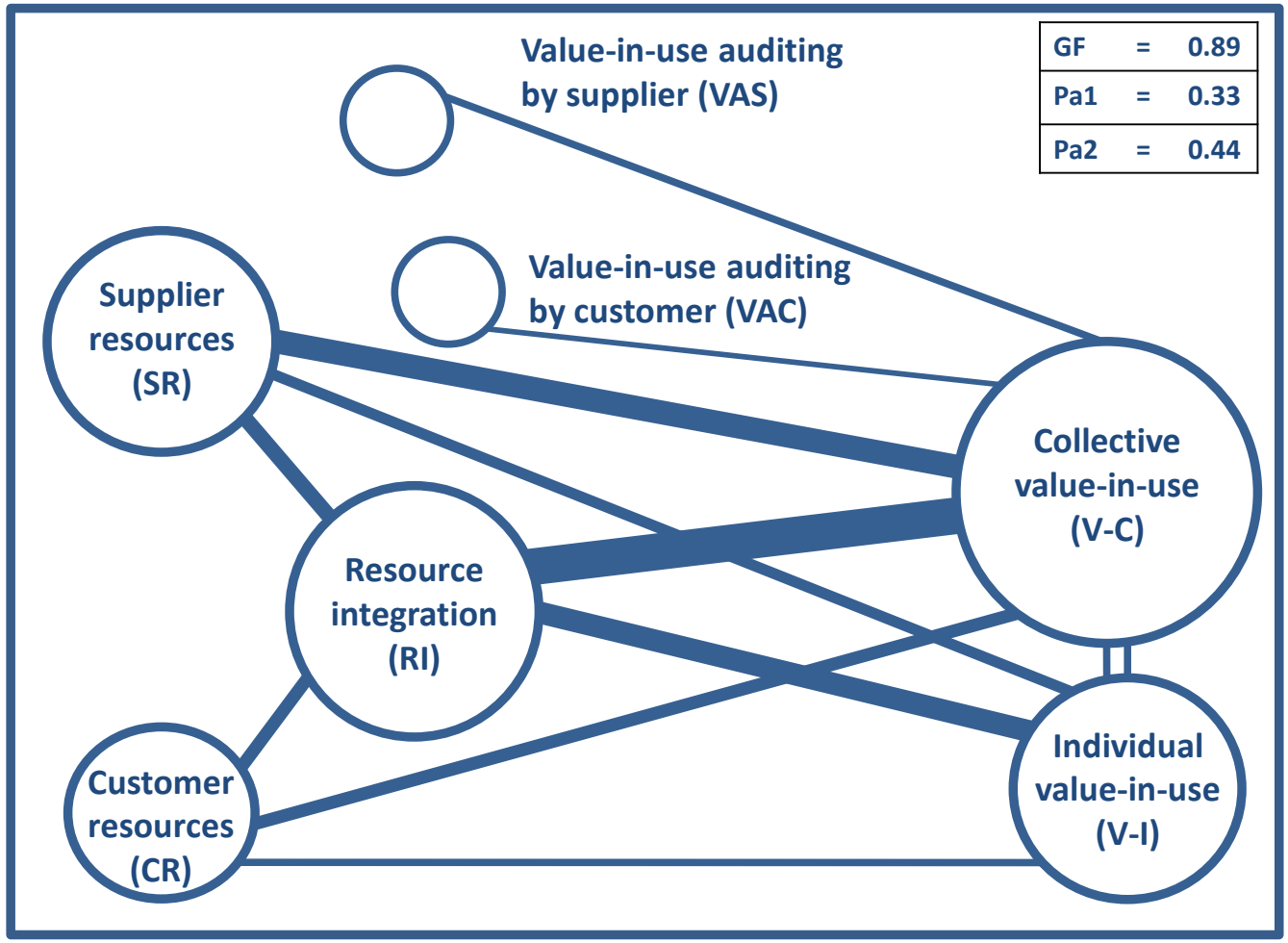


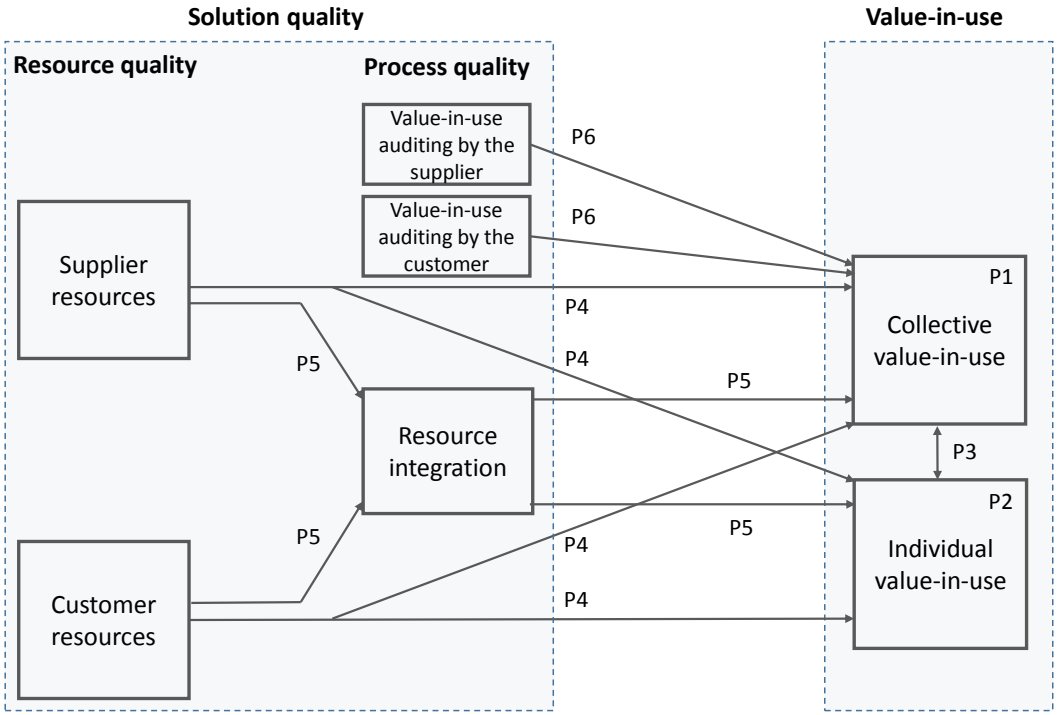
Figure 2: Hierarchical Value Map (Total Sample)



The horizontal axis represents the construct's abstractness (0 to 1); the circle area is proportional to construct centrality; the line thickness is proportional to the number of implications between two constructs. Number of implications represented in this map = 1021. GF = Goodness of Fit (% of all implications), Pa1 = Parsimony1 (% of all squares in the matrix), Pa2 = Parsimony2 (% of all non-zero squares in the matrix).

Figure 3: How Solution Quality Leads to Value-in-Use

a. Quality-value relationship



b. Moderators of quality-value relationship

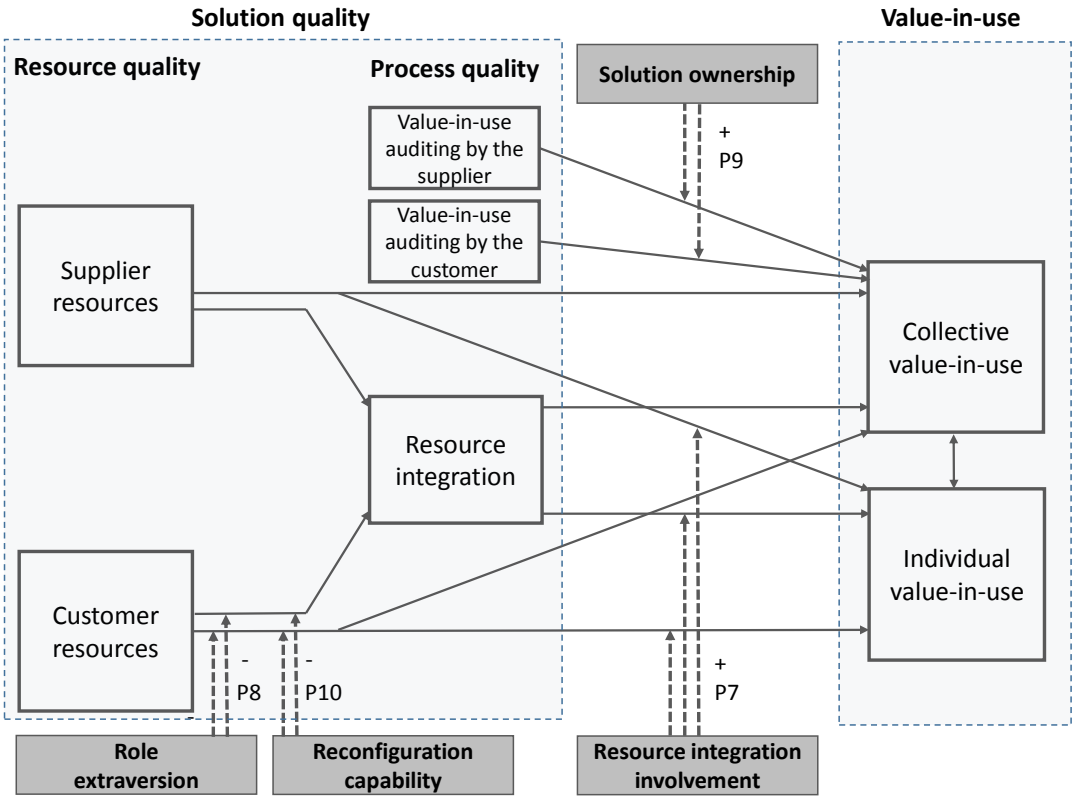
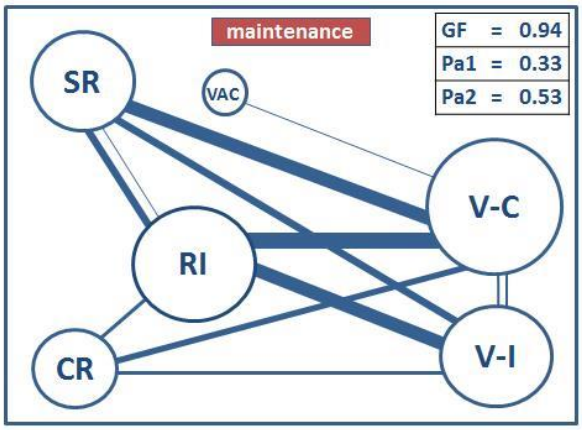


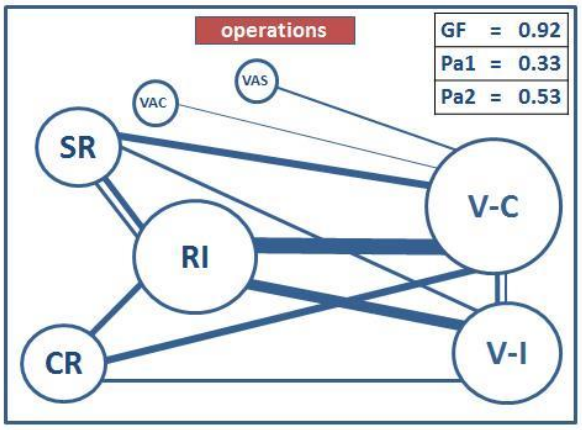
Figure 4: Hierarchical Value Maps (Sub-Samples)

Job role[1,2]

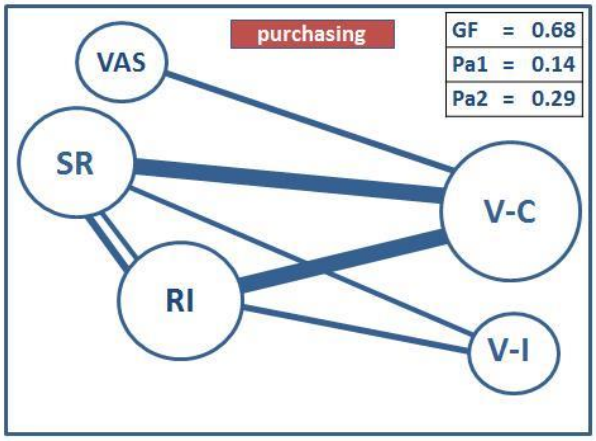
a. Implications =469



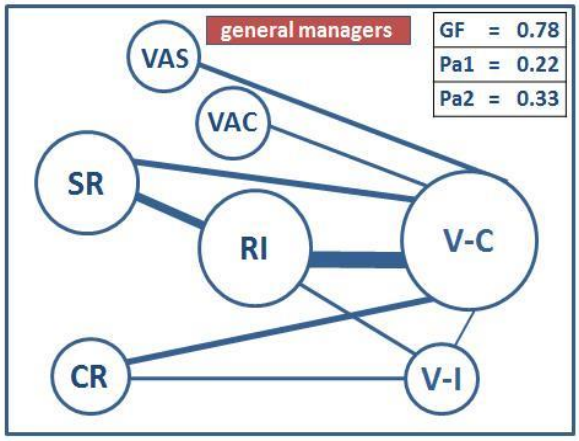
b. Implications =262



c. Implications =100

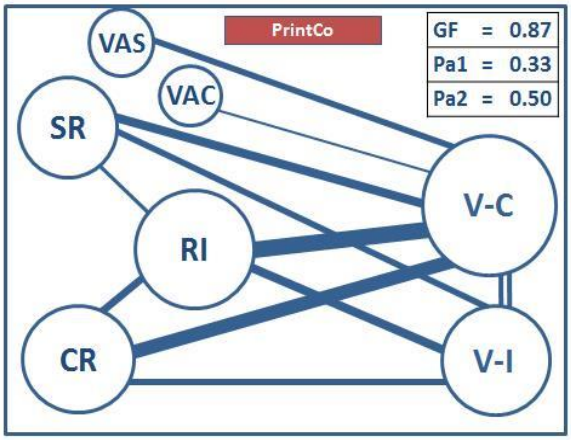


d. Implications = 109

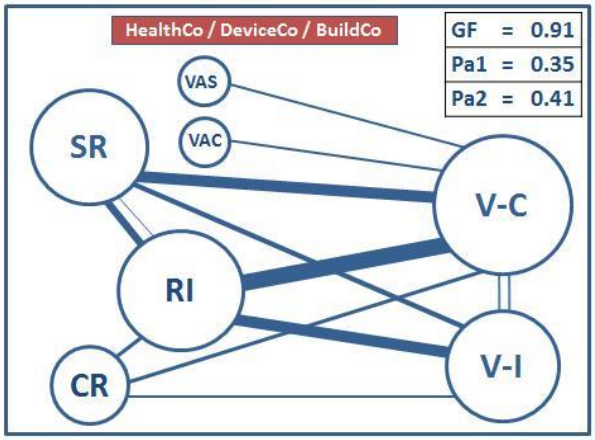


PrintCo versus other companies[1,2]

e. Implications = 254



f. Implications =767



1. GF = Goodness of Fit (% of all implications), Pa1 = Parsimony1 (% of all squares in the matrix), Pa2 = Parsimony2 (% of all non-zero squares in the matrix).
2. SR=supplier resources, CR=customer resources, RI=resource integration, V-C=collective value-in-use, V-I=individual value-in-use, VAS=value auditing by supplier, VAC=value auditing by customer.