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Contracting for Servicizing

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CONTRACTING FOR SERVICIZING

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Abstract

Servicizing, a novel business practice that sells product functionality rather than products, has been touted as an environmentally beneficial business practice. This paper describes how servicizing transactions mitigate some problems associated with sales transactions, but creates several others. The success of servicizing—or product service systems—requires manufacturers to develop contracts that attract customers while protecting their interests. Several propositions are offered to facilitate empirical testing of the concepts discussed.

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1. INTRODUCTION

A new type of transaction, often referred to as servicizing, involves suppliers providing functionality rather than products: consumers buy flooring services instead of carpeting, server capacity instead of computers, and climate control services instead of heaters and air conditioners. To be sure, servicizing does not eliminate products. Selling functionality does, however, change the nature of the relationship between manufacturers and customers by aligning their incentives to reduce the total cost of product functionality over its entire life span, which has the potential to influence product design.

Many view this model as having great potential to dramatically reduce industrial environment impacts (e.g., Fishbein, McGarry & Dillon, 2000; Goedkoop, van Halen, te Riele & Rommens, 1999; White, Stoughton, & Feng, 1999). For example, selling services may create incentives for manufacturers to redesign products to extend their life span, thereby reducing energy and material intensity (Stahel, 1994). Thus, selling functionality may represent an opportunity to reverse the trend of economic growth requiring increasingly intensive material and energy use.

As a relatively new phenomenon, the preponderance of literature on servicizing remains within the trade press; more rigorous research has just begun (see, for example: Chemical Strategies Partnership, 2000; Lifset & Lindhqvist, 2000; Reiskin, White, Kauffman Johnson, & Votta, 2000; White et al., 1999). This paper contributes to the nascent literature by using insights from transaction cost economics (TCE) to structure contracts to effectively govern servicizing relationships.

The paper proceeds with a brief overview of TCE, followed by descriptions of two types of servicizing. The ensuing section addresses how servicizing mitigates several transaction hazards typically associated with sales transactions. Next, new transaction hazards that arise with servicizing are addressed, along with possible mitigation strategies. The paper concludes with a summary and ideas for further research.

2. TCE OVERVIEW

Broadly stated, TCE focuses on predicting the structure that most efficiently governs particular transactions. This section presents the behavioral assumptions, alternative governance structures, and transaction characteristics that are key to TCE theory. TCE makes several key assumptions about managerial behavior when determining which governance structure is most

efficient for a particular transaction. The choice of governance structure depends upon the extent to which a transaction possesses key characteristics.

2.1 Behavioral Assumptions

Bounded rationality and opportunism are two assumptions regarding managerial behavior that underpin TCE. Bounded rationality refers to the assumption that actors are “intendedly rational, but only limited so” (Simon, 1961: xxiv) due to cognitive limitations. Thus, instead of maximizing utility, actors engage in *satisficing* which enables them to “find a course of action that is good enough” (Simon, 1957: 204), where marginal benefits of seeking to increase utility approximates the marginal cost of continuing to mull over how to do so. The implication is that all complex contracts are inherently incomplete — both because *all* possible combinations of contingencies (and best responses to each contingency) cannot be predicted, and because if they could, the *optimal* response to each contingency could not be generated.

TCE also assumes managerial behavior is motivated by opportunism, which runs the spectrum from blatant types (e.g., lying, stealing and cheating) to more subtle forms of deceit. Williamson defines opportunism as “self interest with guile” (1985: 47) and identifies several circumstances where opportunism challenges contractual relations. When unforeseen contingencies lead to information asymmetries, parties will seek to leverage their position through strategic concealment of private information. When contractual parties develop mutual dependence, each may attempt to leverage its position by renegotiating or threatening to “hold up” the other party¹.

2.2 Transaction Governance

TCE asserts that transactions are managed — or governed — through one of three discrete structures: the spot market, internal to a firm, or some “hybrid” mechanism. *Market* governance occurs when the transaction parties are distinct legal entities and the transaction occurs on the spot market. TCE assumes that the market structure is the least costly governance mechanism due to its lack of administration costs. In TCE, market governance is considered the default for comparison, and the assumption is made that markets will govern transactions unless particular transaction hazards arise. At the other end of the spectrum, transactions that occur

¹ Williamson (1985) identifies two additional circumstances where opportunism arises in contractual relations. When property rights are weak, parties may seek to appropriate rents or shift terms to their favor. When court enforcement is costly, parties may seek breach to the contract, anticipating the other party’s reluctance to pursue legal remedies.

within the same organization are governed by a *hierarchy* structure. All other intermediate forms of governance, such as long-term contracts and joint venture arrangements, are considered *hybrid* governance forms. TCE claims that governance structures differ with respect to several aspects, including incentive intensity, administrative control, adaptation, and dispute resolution. Incentive intensity refers to the extent to which compensation drives productivity: high-powered incentives result when payment is based on output or performance provided; low-powered incentives provide rewards based on inputs provided.

Administrative control refers to the degree to which transaction parties can effectively coordinate management decisions varies across governance structures. Adaptation is a related notion: when each transaction party can autonomously implement changes, decision-making is expedited. However, when coordinated changes are required, structures with greater administrative control facilitate more efficient coordinated adaptation.

Dispute resolution mechanisms provide another important difference among governance structures. Parties to market transactions can use the courts or arbitrators to resolve disputes based on legislation and common law. Courts rarely, however, intercede in disputes among parties to a transaction within the same organization,² which typically provides more latitude for senior managers to settle disputes unilaterally and more swiftly than contracts between distinct organizations (Williamson, 1985).

The following table summarizes the relative strengths of each governance structure with respect to the attributes discussed above.

Insert Table 1 about here

2.3 Key Transaction Characteristics

Selecting the most efficient governance structure depends upon several critical transaction dimensions, including the degree to which transaction hazards arise from asset specificity, uncertainty, and frequency. Williamson (1983) identifies four types of asset specificity: site specificity (e.g., proximity to customers or raw materials), physical assets (e.g., a specialized die), human assets (e.g., specialized training), and dedicated assets (e.g., installed production capacity reserved for a particular customer). The nature of these assets is that they are specific to a particular transaction, and substantial investment would be required to redeploy

them to other transactions. Transactions that feature high asset specificity are less likely to operate efficiently within market transactions due to the substantial risk that the investor in specific assets could be blackmailed by its counter party. Because some specific assets can be diverted to other productive uses, hold-up problems are most acute when assets are non-redeployable³ (Klein & Leffler, 1981).

Uncertainty is the second critical transaction dimension. Because every contractual contingency cannot be foreseen and contracts are inevitably incomplete, unforeseen contingencies inevitably disturb a relationship. Because uncertainty exacerbates the transaction hazard (to market governance) posed by asset specificity (Williamson, 1985: 59), TCE suggests that, by providing more administrative control and coordinated adaptability, alternative structures more efficiently govern transactions involving higher degrees of uncertainty.

Transaction frequency also becomes relevant when transactions involve asset specificity. In such cases, transactions that bring the parties together more frequently provide more occasions for opportunism. Again, because hierarchical governance facilitate more administrative control and coordinated adaptability, frequent transactions involving specific assets are often better handled within a single organization. On the other hand, the transactions involving specific assets that occur infrequently make it less attractive for a firm to bear the administrative costs by internalizing the transaction.

Each of these above transaction features -- asset specificity, uncertainty, and frequency -- poses hazards that are not well addressed by unassisted market governance and suggest the need for hybrid or hierarchy governance. The decision regarding which governance structure best economizes transaction costs under each combination of transaction attributes is the principle puzzle that the TCE theory seeks to solve. When parties face transaction hazards, mitigating contractual safeguards can be devised to facilitate transactions and mutual gains. For example, facing a potential hold-up problem, a credible commitment can be made to increase the likelihood that both parties will fulfill their obligations⁴ (Williamson, 1983). Whether a

² Exceptions include issues of social significance, such as worker safety and discrimination.

³ The implications are seen in common transactions. For example, when ordering custom tailored suits, clients effectively ask tailors to make a non-redeployable investment: their time can never be recouped for productive use elsewhere, and the materials themselves are barely redeployable. As a result, tailors are vulnerable to a potential hold-up problem should opportunistic customers seek to renegotiate the price after the suit has already been made.

⁴ Applied to the above example, to gain a credible commitment from customers, tailors often require customers to leave a significant deposit.

credible commitment is extended or a formal contract is employed to specify dispute resolution steps should anticipated contingencies arise, this transaction would be governed by a hybrid structure. Alternatively, internalizing the transaction into one organization by employing hierarchy governance may mitigate such hazards.

2.4 Summary

According to TCE, transactions occur most efficiently in markets, unless an idiosyncratic asset is required for the particular transaction (asset specificity), or the terms of exchange are particularly uncertain or frequent. These transaction hazards result from particular assumptions regarding human tendencies including bounded rationality and opportunistic behavior (Williamson, 1985). TCE holds that when organizations face make-or-buy decisions, they pursue the governance structure that achieves the desired result while economizing transaction costs.

A fundamental notion within TCE is that comparisons should be made only between feasible alternatives, not hypothetical ideals (Williamson, 1985). In this paper, servicizing relationships are usually compared to “typical sales transactions”, which I define as a customer purchasing an asset or input material from a supplier, with the supplier providing at most a warranty of limited duration, and the customer being financially responsible for any subsequent maintenance, repairs, and disposal.

3. SERVICIZING

In its nascent literature, servicizing has been defined fairly simply as “selling a service instead of a product” (Makower, 2001: 8) and, similarly, as “selling the function of a product or the service it provides, rather than the physical product” (Fishbein et al., 2000: 1). These definitions are overreaching, however, as many business transactions that meet these definitions but are not considered examples of servicizing (e.g., automobile renting). An even broader definition is offered by White et al.: “product-based services which blur the distinction between manufacturing and traditional service sector activities” where manufacturers’ “involvement with the product is extended and/or deepened in phases of the product lifecycle” (1999: 2). Concurrently emerging are alternate terms and phrases including “functionalization” (Stahel, 1997) and “product service systems” (Goedkoop et al., 1999: 18) that refer to the same concept. That a consistent definition for servicizing has not yet emerged is not surprising because this concept represents a new paradigm (Kuhn, 1962) of business operations.

To provide a sharper definition necessary for this paper's micro-analytical approach, I assert that servicizing describes transactions that possess the following four features:

1. The manufacturer sells its product's functionality, but not the product itself, to the customer.
2. The manufacturer maintains ownership of the product it manufactures. Ownership of the asset never transfers to another party.
3. The customer pays a fee to the manufacturer based solely on product usage (i.e., pay per use).
4. The manufacturer maintains and repairs its products at no additional cost to the customer.

Servicizing includes scenarios where the product either remains at the manufacturer's site or is installed at the customer's site. Two types of servicizing transactions can be distinguished based on whether the manufacturer or the customer directly uses the product to deliver its functionality. This novel distinction is introduced due to its importance in describing the transaction costs associated with servicizing. Each type is discussed below.

3.1 Servicizing Types

3.1.1 Manufacturer-User Servicizing. In this type of servicizing, the manufacturer replaces the customer as the user of its product. This is typical when a customer outsources an entire process to the manufacturer. A recent report forecasted a \$10 to \$13 billion potential U.S. market within just eight sectors for chemical management services, where a company's chemical supplies and related management services are outsourced to a long-term service provider (Chemical Strategies Partnership, 2000). For example, instead of supplying automobile paint to Ford UK and being paid per gallon of paint, DuPont has taken over its customer's paint operations and is now compensated on the basis of the number of cars painted (White et al., 1999). In its chemical management service, Castrol assumes responsibility for all aspects of its customers' in-house chemical management including monitoring and controlling procurement, warehouse management, chemical handling and usage, and disposal (Castrol Industries, 2001). Castrol charges a fixed fee and earns a share of the cost reductions that its customers realize through its service. Additional manufacturers providing chemical-related servicizing include Air Liquide America Corporation, Air Products and Chemicals, Arch Chemicals, Ashland, Calgon Carbon Corporation, Ecolink, GW International, PPG Industries, and Quaker Chemical

Corporation (Chemical Strategies Partnership, 2000)⁵. Essentially, manufacturer-user servicing is a particular form of outsourcing that features a unit-based pricing structure.

3.1.2 Customer-User Servicing. Customer-user servicing is a particular type of bundled lease that features a unit-based pricing structure and comprehensive maintenance, repair, and service. Here, customers use the product. For example, AB Electrolux installs a washing machine in a customer's home, maintains and repairs it when necessary, and charges customers by the laundry load. Interface installs flooring tiles at customer sites, inspects it monthly, replaces any worn tiles, and charges customer by the square foot.

Both types of servicing are illustrated in Table 2, which also distinguishes them from typical sales transactions.

Insert Table 2 about here

As shown in the above table, both types of servicing involve transferring several processes from customers to manufacturers. Thus, servicing may be viewed as a form of outsourcing. While servicing is at the nexus of outsourcing and selling services, two burgeoning strategic management trends toward, this transaction mitigates and evokes new transaction hazards, which are discussed in the remainder of this article.

4. SALES TRANSACTION HAZARDS MITIGATED BY SERVICIZING

Servicizing mitigates several transaction hazards associated with typical sales transactions, which in turn reduces transaction costs and provides new incentives — both of which create opportunities for mutual gains.

4.1 Reducing *ex post* Contractual Hazards Induced by *ex ante* Information Asymmetry

With typical sales transactions, the manufacturer's concern over reliability, durability, maintenance costs and repair costs is limited by the extent to which these attributes impact brand reputation and pricing. With imperfect information, the manufacturer typically possesses better knowledge than customers of a product's expected reliability and durability and – because of opportunism – the manufacturer will tend to exaggerate these characteristics in its marketing

⁵ In addition, a few chemical distributors including Haas Corporation and Interface LLC provide chemical management services. However, because there are additional transaction hazards involved in the relationship between the distributor and the manufacturer, analyzing this relationship is beyond the scope of this paper but creates an opportunity for further research.

efforts. Detecting exaggerated claims is particularly challenging because reliability and durability are largely non-observable *ex ante* even by the most scrupulous customers.

With servicizing, this information asymmetry loses relevance because the manufacturer becomes liable for reliability and durability. The customer only pays for the functionality (i.e., output) of the equipment and no longer directly bears the cost of repairs, maintenance, or replacement. To the extent that these attributes differ between manufacturers, these costs will be built into the service price. Therefore, one advantage of the servicizing model is that it reduces *ex post* contractual hazards associated with typical sales transactions, where customers often end of paying dearly for required repairs and spare parts — at prices and frequencies that often exceed their expectations when they purchased the equipment based on “optimistic” promises from manufacturers.⁶

4.2 Higher Incentive Intensity Increases Efficiency

The shift from typical sales transactions to manufacturer-user servicizing does not change the fact that the asset is owned, used, maintained, and repaired by the same party; it simply changes it from the customer to the manufacturer. For example, with some types of chemical management services, all responsibilities associated with chemical delivery, storage, and usage are shifted from the customer to the supplier. However, what does change is the payment mechanism. In servicizing, customer incentives shift from minimizing the equipment’s purchase price (which is no longer relevant) to maximizing the operational efficiency of equipment use. To encourage efficiency of its internal staff, the customer’s management is limited to low-powered incentives, which reward inputs (e.g., hours worked) with the expectation that this will translate to productivity (Williamson, 1985). In servicizing, the supplier assumes these responsibilities and is paid per unit output that meets specified quality criteria. An efficiency gain derives from the use of high-powered incentives -- which reward productivity directly (e.g., by paying per unit delivered) -- and the assumption that the manufacturer possesses more expertise in the use of its product.⁷

With the transition from low-powered to high-powered incentives, servicizing creates a stronger incentive for the manufacturer to reduce the cost of the product’s functionality than

⁶ This is due to the “fundamental transformation”, which is described in more detail later.

⁷ The human capital expertise required by the manufacturer to acquire and maintain deep knowledge of its customers’ processes is discussed below.

typical sales transactions provides for the customer's internal staff. This suggests that a more efficient result obtains in the servicizing model, as the higher-powered incentive will drive the manufacture toward innovative and cost-saving methods to improve its profitability. This replaces the customer's lowered power incentive to manage the inputs of this sub-process. This opportunity for mutual gains is illustrated in Figure 1.

Insert Figure 1 about here

The gain derives from the higher intensity incentives applied to use, maintenance and repair in the servicizing model. The difference is greater for assets that: (a) are less critical to customer profitability, since customers will have less incentive to closely manage these; and (b) are more specific assets which provide greater opportunities for manufacturers to exploit their specific human capital (knowledge) advantage in using, maintaining, and repairing the asset.

4.3 Aligned Incentives Create Opportunities for Mutual Gain

With typical sales transactions, there are many conflicting objectives between the manufacturer and the customer. One example was discussed above: the manufacturer seeks to reduce costs of non-observable product attributes, whereas the customer seeks to ensure high quality and durability. The manufacturer seeks a high price, whereas the customer seeks a low price. The manufacturer weighs profits it can earn from providing repairs and maintenance—if it is selected by the customer to provide after-sale service—against reputation damage that might result from its equipment's poor reliability. A key determinant is its ability to accurately forecast both how quickly and effectively its reputation would be sullied by its poor equipment reliability, and how such reputation damage would result in sales lost to competitors.

For consumables, manufacturers often seek to maximize revenues by selling as many units as possible, whereas the customer seeks to minimize its costs by purchasing as few units as possible. This disparity of interests also appears as manufacturers seek to sell larger or more elaborate models than customers actually require, as may occur when the manufacturer recommends heating, ventilation, air conditioning (HVAC) equipment or pollution emission control equipment to less knowledgeable customers.

Because servicizing involves most stages of the equipment's lifecycle being managed by a single organization (the manufacturer), servicizing resolves many of the aforementioned conflicts. In servicizing, the product is no longer sold, so neither party focuses directly on

purchase price. Repair costs are borne by the manufacturer in the servicizing model, and thus the manufacturer no longer profits from service calls and the (typically highly lucrative) sale of spare parts. The manufacturer becomes motivated to minimize maintenance costs, since in servicizing it bears these costs as well. In the servicizing model, the customer is no longer directly concerned about these issues because it no longer directly bears these costs.⁸

With consumable goods sold at a fixed unit price, manufacturers typically seek to maximize sales volumes while customers seek to minimize procurement volumes. This conflict of interests is also resolved in servicizing. The extent of functionality provided, and not simply the amount of product, is the key paradigm shift that servicizing offers. A key result is that *both* parties seek to ensure functionality meets contractual specifications, and when the service fee includes operating costs, the manufacturer becomes concerned with reducing material and energy costs. While the manufacturer is motivated within the fixed unit fee structure to minimize such costs to increase profitability, the customer shares this motivation for reducing costs because it can later attempt to negotiate lower rates upon contract renewal. This incentives alignment is of particular importance to those touting the environmental benefits of servicizing, as it provides a novel opportunity to disassociate economic value added (and, on a larger scale, economic growth) from requiring increasing consumption of materials and energy. However, this efficiency depends on the manufacturer being responsible for operating costs, while being paid on a per unit basis.⁹ The harmonization of incentives provided by servicizing is illustrated in Table 3.

Insert Table 3 about here

With typical sales transactions, the manufacturer of a consumable product *benefits* from customer mismanagement that results in increased product usage. For example, consider the changed incentives with a manufacturer-user servicizing arrangement. In the traditional sales model, a paint manufacturer profits when customers use paint inefficiently, such as when they overuse or spill paint. However, in a servicizing arrangement that compensates the manufacturer

⁸ The customer maintains an indirect concern, however, to the extent that higher costs borne by the manufacturer to provide the contracted functionality may lead to higher service fees. However, opportunities to increase service fees presumably only arise periodically. While the fundamental transformation predicts some extent of bilateral dependency (explained later), this is limited by the magnitude of switching costs.

for providing paint service on the basis of square feet or units painted to meet a particular specification, the manufacturer is motivated to increase efficiency and reduce cost and waste — the very same objectives held by the customer (Reiskin et al., 2000). As a second example, consider a customer-user servicing transaction involving a cooling tower. In a sale, the manufacturer's profits typically increase with the size of the equipment deployed. Assuming the manufacturer knows more about sizing equipment than the customer, this information asymmetry will lead to opportunism and an attempt by the manufacturer to recommend larger, more elaborate systems that a customer actually requires. With servicing, manufacturers bear the operating costs and thus have the incentive to size the equipment to meet the customer's needs at the lowest total costs. The difference is illustrated in Figure 2 and elicits the following propositions.

Insert Figure 2 about here

Proposition 1: Companies that deploy equipment using the servicing model will select smaller models for the same customer circumstances compared to those companies selling equipment.

Proposition 2: Servicing is more likely to occur with complex products and equipment where the primary sources of customer education are various sales personnel.

The above discussion focused on how servicing mitigated several transaction hazards associated with typical sales transactions. Servicing is not the panacea of transactions, however, as it creates new transaction hazards and exacerbates some associated with typical sales transactions.

5. NEW TRANSACTION HAZARDS INVOKED BY SERVICIZING

This section discusses several new transaction hazards that arise with servicing, including bilateral dependency and bilateral monopoly. Next, I argue that, compared to sales transactions, servicing transfers four risks from customers to manufacturers. Finally, adverse selection and moral hazard problems that arise from servicing are addressed

⁹ Broader environmental gains result from incentives provided to manufacturers to extend product life span and recyclability — which result from their maintenance and disposal responsibilities. These are discussed later.

5.1 Tighter Integration Leads to Bilateral Dependency

Servicizing transfers the responsibility from the customer to the manufacturer of ensuring that the product's functionality meets the customer's requirements. As the transaction changes from an asset sale to a long-term service contract, the closer coordination required between the two parties leads to bilateral dependency. First, consider how the customer becomes more dependent upon the manufacturer. If the manufacturer assumes responsibility for a process that is tightly integrated into the customer's production line, the customer risks being held hostage to any breakdowns – accidental or strategic – in the manufacturer's ability to provide service. For example, if the supplier is handling a subprocess in a continuous flow or just-in-time production line, the customer's entire production may be disrupted if the supplier's equipment fails and is not repaired immediately. Second, consider the manufacturer's plight. A manufacturer's deployment of even the most generic equipment at a customer site incurs time, expense, and opportunity cost for the manufacturer. In the servicizing model, the manufacturer charges a fee based on service provided, so if the customer changes its plans reduces the volume of service required, the manufacturer's profitability suffers.

Bilateral dependency results because the profitability of each party is highly dependent upon the other's action. As a consequence, manufacturers and customers seek to gain each other's trust to convince their potential counter-parties that they can be relied upon to act honorably when unforeseen contingencies arise. For example, a key element of Castrol Industrial Americas' marketing of its Castrol+Plus® chemical management services is "Expertise You Can Trust" (Castrol Industries, 2001). This emphasis implies an acknowledgement of this transaction hazard that arises when two separate entities seek to coordinate closely.

Indeed, TCE suggests that integrated management is better suited for such transactions due to its administrative control and faster dispute-resolution by "management fiat" (Williamson, 1991: 276). Servicizing, as a form of contracting, is less well suited to manage transactions that require ongoing coordination. While contracts may stipulate some coordination actions, bounded rationality suggests that all contingencies cannot be foreseen, and thus coordination and dispute resolution cannot be completely defined contractually. Furthermore, tight coordination often requires frequent interaction, which increases the chances that unforeseen circumstances will arise and thus provides more occasions for opportunistic behavior.

TCE's assumption of opportunism leads to the conjecture that when parties become

dependent upon one another, each may attempt to leverage its position by renegotiating terms or threatening to hold-up the other party. Consequently, with servicizing, the tight integration of a manufacturer into a customer's supply chain may result in inherent coordination difficulties and hold-up risks. Together, these contribute to greater uncertainty, which exacerbates the hazards.

Mitigation. While TCE assumes managers' rationality is bounded, Williamson asserts that managers possess feasible foresight, which enables them to "look ahead, recognize potential hazards, work out the contractual ramifications, and fold these into the ex ante contractual agreement" (2000: 601). The customer may, for example, stipulate service level guarantees including penalties for periods of service unavailability. The manufacturer may seek to protect its interest by stipulating minimum service volumes in the contract to protect its investment. The importance of getting the incentives right to reflect the new relationship is thus a critical factor for the relationship to run smoothly. Apparently, some manufacturers that have begun implementing servicizing relationships have not yet realized the importance of these issues. The investigators in a recent study of such companies concluded: "The limited information the companies were willing to disclose on the subject of incentives and metrics suggests that they often are dealt with post-hoc, and on an ongoing basis" (White et al., 1999: 30).

5.2 Asset Specificity and Bilateral Monopoly

When the asset a customer requires is highly specialized to a particular transaction, a bilateral monopoly develops between the supplier and customer. Klein, Crawford, & Alchian (1978) assert that this contractual problem creates incentives to internalize such transactions (i.e., by purchasing highly specialized assets). In addition, the authors hypothesize that generic assets—which by definition feature low asset specificity—are far more likely to be deployed through leasing transactions since the hold-up problem is of less concern. This discussion is relevant to servicizing: if a customer requires a highly customized service, transaction hazards increase because the manufacturer risks losing its investment in specialized equipment and training if the customer changes tactics after the manufacturer makes non-redeployable investments but before it has earned its expected return. To mitigate this hazard, manufacturers will seek to imbed various safeguards into the servicizing contract, such as requiring longer-term commitments from the customer or higher penalties for early contract terminations than would prevail for more generic assets.

Highly specialized assets also pose problems for customers. After the manufacturer

makes its non-redeployable investment to service the customer, the manufacturer may obtain comparative advantages over its competitors. For example, it may realize cost efficiencies from learning-by-doing (i.e., climbing a learning curve), or it may acquire deep customer knowledge that provides a comparative advantage in designing better productivity into the next generation of equipment – for this particular customer or for other customers with similar needs. The manufacturer is likely to gain more customer knowledge in a servicing relationship than an arms-length sale due the heightened coordination servicing requires. Thus, even if the initial bidding process to become the service provider were competitive, the information acquired by the winning service provider during contract execution may provide such an advantage that a small numbers problem results — both during contract execution and in subsequent contract renewal periods.¹⁰ If this transformation is unforeseen, a disparity in power is likely to arise after the contract has been signed (Williamson, 1993: 463). Despite managers’ feasible foresight, bounded rationality limits their ability to anticipate every contingency. Furthermore, opportunism suggests that when unforeseen contingencies arise, each party will leverage the circumstances to enhance its own interest.

5.3 Transferring Product Selection Risk

With typical sales transactions, the customer bears the risk of selecting the best product to suit its anticipated requirements. The customer faces two obstacles in this task: selecting the appropriate mix of features, and maximizing the accuracy of the information upon which it bases its decision. Each of these issues is discussed below.

5.3.1 Search costs. With typical sales transactions, customers bear search costs as they seek to gather information to learn about the range of products available on the market. In servicing, the manufacturer bears the risk of selecting and deploying its most suitable product to provide the required functionality to the customer in the least costly manner. With servicing, because the manufacturer bears commissioning and decommissioning costs, selecting a product that cannot meet the contractually stipulated service levels—in terms of volume and quality—can be a costly error. In addition, the manufacturer’s service fee is based (to some extent) on its projected operating costs, and the particular equipment it expects to

¹⁰ This transition that reduces the competitiveness of bidding on contracts that feature asset specificity is a result of the *fundamental transformation*, which asserts that for transactions involving specialized investments, “what was a large-numbers bidding condition at the outset is effectively transformed into one of bilateral supply thereafter” (Williamson, 1985: 61).

deploy is of critical importance to its profitability forecasts. Therefore, servicizing provides the manufacturer with strong incentives to ensure that it selects the best product to meet the functionality required by the customer.

While servicizing reduces search costs for the customer, the manufacturer acquires new search costs. Although this paper has defined servicizing narrowly, such that a manufacturer offers the functionality of *its own* products, this is not a real-world limitation of the servicizing business model. For example, suppose a manufacturer contracts with a customer to provide a comfortable temperature during normal business hours. Such a contract, for example, might stipulate 68-72°F between 8am and 6pm Mondays through Fridays. (This replaces a bill of sale for providing air conditioners, heaters, and ductwork with typical sales transactions.) In servicizing, the manufacturer will be motivated to explore opportunities to reduce its costs of providing the stipulated service. Beyond properly sizing its equipment and providing optimal preventative maintenance, the service provider may also investigate installing additional insulation, fitting light bulbs that emit less heat, and applying invisible window film that blocks heat. If the servicizing manufacturer were formerly in the HVAC equipment sales business, its transition to a servicizing model creates new search costs as it seeks to identify complementary products that will reduce its service delivery costs, because now its business is of controlling building temperature.

5.3.2 The integrity of product attribute claims. With typical sales transactions, customers are often disadvantaged by information asymmetry because they know less than manufacturers about the accuracy of marketing claims. Manufacturers are assumed to opportunistically leverage their information advantage about their products' features that are *ex ante* difficult to verify, such as by exaggerating claims of reliability and efficiency. Customers attempt to discern the credibility of manufacturer claims through some combination of their own and other customers' experiences (e.g., through the use of trade magazines and industry associations). This source of uncertainty is reduced in the servicizing model because customers no longer purchase the product but rather contract for service. Product claims no longer matter to customers.

Servicizing creates a different type of uncertainty, borne by manufacturers. While manufacturers are much better positioned to leverage accurate information about their products, they are now beholden to customers to disclose projections about their anticipated levels of

desired service quantity and quality. Opportunism suggests that customers will seek to leverage their information advantage by disclosing projections that favor their position. For example, if higher anticipated quantities reduce their service fee, one can easily imagine customers disclosing their most optimistic forecasts.

5.3.3 Mitigation. With feasible foresight, manufacturers will anticipate customers' strategic posture and will take steps to mitigate this transaction hazard through contractual safeguards. For example, while the manufacturer's proposed service fee may indeed decline with higher anticipated service volumes, such discounts may be offered retroactively upon actual achievement of the targeted volumes.

5.3.4 Summary. Servicizing reduces the transaction hazard associated with customer uncertainty regarding product selection due its search costs and information disadvantage. However, the manufacturer bears new transaction hazards associated with its uncertainty of customers' stated projections of their service requirements. Although some servicizing providers will also bear new search costs for complementary products to reduce their service provision costs, the impact would be largest during the transition to the servicizing model. After the transition, the service provider would develop economies of scale in managing these search costs.

5.4 Transferring Production Downtime Risk

With typical sales transactions, a customer purchases an asset and subsequently decides whether to provide maintenance and repair services via in-house resources, the manufacturer, or a third-party. In servicizing, the manufacturer assumes responsibility for providing service. Compared to providing its own maintenance and repairs, the customer becomes much more dependent upon the manufacturer in the servicizing model. While shopping for a functionality-provider, the customer may face a choice of several suppliers. However, once the contract is signed, the fundamental transformation occurs and the relationship devolves to a small numbers problem: the market is no longer competitive because there is only the single manufacturer that provides maintenance and repair services.

The customer risks incurring losses should the manufacturer fail to provide functionality due to equipment downtime. The manufacturer could seek to opportunistically leverage this dependency. For example, after contracting and deploying the assets at the customer site, the manufacturer may decrease its maintenance staff or dispute legitimate customer concerns over

quality, which may be difficult to meter objectively.¹¹

5.4.1 Mitigation. Customers exhibiting feasible foresight will seek to mitigate this transaction hazard with contractual safeguards. For example, a customer may stipulate maximum acceptable duration of production downtime, assigning penalties when this threshold is exceeded. However, because bounded rationality prevents complete contracting, contractual mechanisms typically cannot completely assure the customer that the manufacturer will not abuse the customer's dependency.

Customers of manufacturers who value their brand reputation may gain additional relief against opportunism. Manufacturers who rely on their reputation to compete in the marketplace are better positioned to gain confidence from customers who, in the servicizing model, inevitably become more dependent upon manufacturers. As such, customers can more heavily rely on reputable manufacturers to not abuse the dependency situation. This implies that contracts with more reputable manufacturers can be expected to be more informal and stipulate fewer contingencies than contracts with less reputable manufacturers.

Proposition 3: Companies with reputable brands are more likely offer servicizing relationships than those with less reputable brands.

Proposition 4: For a particular functionality, the number of contingencies specified in servicizing contracts will be inversely proportional to the repute of the parties.

5.4.2 Risk Allocation Efficiency. A manufacturer's greater experience with its equipment may provide it with a comparative advantage over customers and third party vendors in predicting the life span of the equipment's subcomponents and consumables — knowledge critical for optimizing maintenance schedules. The manufacturer possesses additional information advantages: it has the most knowledge about how the equipment was designed and knows the actual cost of replacement parts. These factors suggest that if the manufacturer can accurately monitor the intensity of the customer's product use, the manufacturer's private information may provide it with a comparative advantage in optimizing routine maintenance and thus minimizing this cost.

Furthermore, the manufacturer possesses another key advantage: control over product design. When the manufacturer bears the cost of repairs and maintenance, it will re-evaluate equipment design in response to the strong incentives to reduce *its* maintenance and repair costs.

¹¹ The problem of metering is discussed in more detail later.

Such enhancements might include improving the equipment's durability to reduce the expected frequency of repairs, reducing the labor intensity of repairs by developing equipment self-diagnostic capabilities, reducing the cost of replacement parts, and increasing the residual value of worn parts by raising the prospects for their being reused or recycled.

5.5 Transferring Quality Risk

As discussed above, when equipment is sold, information asymmetry exists between the seller and buyer. Compared to customers, manufacturer typically have much more knowledge about their equipment due to the detailed knowledge required for their design, and their experiential learning from product tests and customer feedback. This information asymmetry is costly to overcome and gives rise to a transaction hazard (Williamson, 1985: 212) that is of particular concern for difficult-to-measure attributes such as durability and quality. With sales transactions, manufacturers often recognize this customer concern and respond by offering mitigating sale terms such as money back guarantees and warranties to reduce customer risk.

As the servicizing model replaces the sales transaction with a service contract, customer concerns over the asset's durability and quality are replaced with similar concerns over the service quality provided by the manufacturer. However, the metering problems discussed above are less of a problem for services when customers can more completely stipulate the requirements of the service desired. Essentially, servicizing shifts many of the issues that are more difficult to measure from the customer to the manufacturer. An example is illustrative.

Suppose a typical sales transaction involves an automobile manufacturer buying a car door-stamping machine from the machine's manufacturer. The customer seeks to learn as much as it can about the machine to ensure that its quality and durability justify its price. The supplier has the incentive to exaggerate these unobservable attributes. While the customer may seek to stipulate a level of quality it requires (e.g., equipment uptime, precision, and durability), the manufacturer would hesitate to guarantee these attributes since they depend in part on proper use, maintenance, and repair — all of which are under the customer's control. The information disparity never equilibrates in such transactions: the customer will always remain at an information disadvantage. In a servicizing transaction, however, the customer is much less concerned about whether the equipment will stamp car doors properly, and concerns itself instead with the car doors that the servicizer delivers. Assuming it knows much more about car doors than stamping machines, servicizing makes metering much easier for the customer.

Does this imply that servicizing simply transfers such risks from one party to the other, without achieving any benefit? No, because the manufacturer's information advantage provides it with a comparative advantage to bear the risk of its equipment's difficult-to-meter attributes. Furthermore, the customer is better able to specify the service attributes because it is much closer to its specialized knowledge base. As a result, the servicizing model more efficiently allocates such risks and provides opportunities for mutual gains.

5.6 Transferring Technology Obsolescence Risk

While manufacturers maintain longer-term interests in the ongoing marketability of their existing products, servicizing often offers customers flexibility in changing equipment when service contracts expire.¹² As a result, some risk of technology obsolescence is transferred from customers to manufacturers. In traditional sales transactions, when a new product generation becomes available on the market, the customer of the older equipment faces the decision of whether the expected value of upgrading to the new equipment exceeds its cost of purchasing the equipment, after deducting the (now depressed) residual value of its current equipment. Manufacturers have the incentive to sell products with better technology as they attempt to convince customers that they will benefit from upgrading. However, manufacturers face several limitations with respect to the pace of releasing subsequent generations.

First, manufacturers face fixed costs associated with each product generation. These may include retooling manufacturing facilities, retraining staff, and marketing. Second, because new technology tends to devalue existing equipment, customers may seek assurances against such surprises when they make purchasing decisions. A manufacturer may only offer such assurance with respect to its own strategy, since it is not privy to the strategies of its competitors. However, due to opportunism, the manufacturer has incentives to leverage its private information, and as such cannot be expected to fully disclose its strategy if doing so would reduce its profitability. In summary, typical sales transactions feature several transaction hazards with respect to the risk of technology obsolescence.

Because servicizing manufacturers maintain ownership, the customer's concern shifts from purchasing a soon-to-be obsolete product to signing a contract that extends its commitment

¹² This presumes that costs incurred by customers in changing equipment in a servicizing relationship are lower than changing equipment they own. This is consistent with how servicizing has been defined above, and the comparative advantages manufacturers have in deploying assets, as discussed later.

well beyond the date when new technology reduces the market value of the service it is receiving. Customers may mitigate this risk by including contractual terms that permit early termination. While servicing manufacturers may not possess much of an information advantage in predicting obsolescence of their products¹³, they may develop new ways to leverage their asset base throughout future waves of technology deployment—while accommodating their customers’ desire for mitigation clauses. For example, manufacturers may redesign their products in a more modular fashion to facilitate upgradability, though a substantial limitation is the inability to design upgrade options for future technology that has does not yet been developed (Wexler, 1992). Where successful, a modular approach enables manufacturers to sell customers just the valuable component they require. Such design innovation may result from servicing assigning manufacturers the responsibility over so many product stages including reclamation, which can be particularly useful in creating innovative ways for manufacturers to improve their management of obsolescence. Innovations that reduce the total cost of the product provide the opportunity for mutual gains.

5.7 Adverse Selection: Servicing’s Customers

An adverse selection problem arises when an informed party’s decision to engage in a transaction depends upon its privately held information in a manner that adversely affects its uninformed counterparty. This is most relevant to customer-user servicing due to information asymmetries surrounding customers’ equipment usage behavior. The customer knows a great deal more than equipment manufacturers about its propensity to abuse equipment. Yet equipment usage behavior impacts servicing manufacturers’ costs, since abused equipment can be expected to require have more heavy repairs. Indeed, those customers that may profit most from servicing are those customers who abuse and use equipment most intensively, since they would be most interested in transferring to the manufacturer the costs of equipment maintenance, repairs, and depreciation. These customers’ savings would be greater than customers who are particularly delicate equipment users, since the equipment used by the latter would likely require

¹³ With typical sales transactions, customers purchase assets with limited knowledge of when technological advances will render their product obsolete. The manufacturer may possess better information about when its current generation of assets will become obsolete, but only if its own technology improvements prevail over its current products or if it possesses accurate market intelligence of its competitors’ product development efforts. Nonetheless, in most cases a manufacturer’s ability to forecast or influence the timing of its products’ obsolescence is limited. The launch of a new product generation that incorporates novel technology may suddenly and

less repair and maintenance. Anticipating these events, the manufacturer may set its servicing price above its average overall expected costs. Consequently, customers with average or better than average equipment maintenance records may find servicing's pricing scheme to be less attractive than a typical sales transaction. This is akin to the used car lemons problem proposed by Akerlof (1970) and can even eliminate, or "unravel" the market opportunity (Mas-Colell, Whinston, & Green 1995: 440).

Mitigation. To illustrate how a manufacturer can profit under these circumstances, consider the simplified case of two types of customers: those that operate equipment delicately, and those that operate equipment harshly. One solution to the adverse selection problem involves customers signaling their type, which enables manufacturers to offer them a contract version appropriate to their type. For example, manufacturers may offer preferential rates to "delicate" customers. For signaling to work, the manufacturer must be able to accurately distinguish between the customer groups. One reasonable test might be to inspect the customer's existing equipment for signs of abuse.¹⁴

5.8 Moral Hazard: Separating Users from Owners

An additional transaction hazard arises in customer-user servicing, where the customer uses the equipment while the manufacturer maintains ownership and the responsibility for maintenance and repairs. Because the user is not owner, a moral hazard problem arises from opportunism and information asymmetry. The user is not concerned about the asset's residual value and thus has less incentive to care for the asset to enhance its durability than it would if it were the owner (Smith & Wakeman, 1985). As a result, customers can be expected to use the equipment more intensively (Williamson, 1985: 138), which is likely to concern its owner, whose equipment more rapidly loses residual value. Manufacturers are further injured because they bear the costs of the additional maintenance and repairs that arise from the customer's intensive equipment use. As a result, the customer's usage pattern has a great influence on a

dramatically reduce the value of the manufacturer's existing asset that was, until that very moment, considered current. If such a breakthrough is produced by competitor, the manufacturer may be as surprised as its customers.¹⁴ Screening, a second solution, involves manufacturers offering several contract options designed such that customers reveal their type based on the option they select. For example, a manufacturer may offer two contracts. Suppose the more expensive Contract A includes 12 repairs per year while a cheaper contract B includes only two repairs per year. In either case, the manufacturer is exclusively authorized to repair its equipment, but repairs in addition to those provided in the contract are charged to the customer at additional cost. Under these circumstances, we would expect the abusive customer to select contract A and the more delicate customer to choose contract B. Thus

servicizing manufacturer's profitability. These problems are exacerbated when manufacturers are unable to effectively monitor equipment usage. Monitoring is much more easily provided by the user's onsite management due to physical proximity as well as the availability of a broader set of disciplinary options to enforce equipment usage standards, including, for example, docking pay and terminating staff. Manufacturers, on the other hand, may have just one option if abuse becomes extensive: to remove their equipment and terminate the contract.

Mitigation. Feasible foresight assumes that manufacturers will anticipate the above transaction hazards and will take steps to mitigate them. Several alternatives are proposed. First, because servicing is defined in part by a service fee levied based on usage, the incentives for customers to use the equipment intensively are not as strong as they are with lease arrangements where customers pay a flat fee based only start and end dates without any stipulations limiting the intensity of equipment use. Smith & Wakeman (1995) note that where it is relatively inexpensive to measure the intensity of the asset usage, metering can effectively control usage intensity because it allows the owner to more closely approximate marginal cost pricing and avoid moral hazard and adverse selection problems. Because servicing requires fees based on usage, servicing necessarily embeds equipment usage metering, which mitigates the overuse hazard.

A second mitigation strategy for the manufacturer is to schedule routine maintenance based on equipment usage rather than according to the calendar. This enables the manufacturer to protect the equipment's residual value. A third strategy the manufacturer could pursue is to physically limit the customer's ability to use the equipment beyond some contractually stipulated intensity level by installing a regulator. The "tilt" feature that ends the game when the user abuses a pinball machine provides a classic example. Finally, the manufacturer could stipulate maximum equipment usage intensity levels and assess surcharges when usage that exceeds these thresholds.

Several of these recommended mechanisms require monitoring, which may be costly for the manufacturer. To reduce its monitoring costs, manufacturers may attempt to observe equipment usage during their routine maintenance visits, and they can compare equipment repair experience across their customer base. Manufacturers may also install electronic devices to

designing contracts may require offering several alternatives to ensure the manufacture is provided with adequate returns while providing customers with attractive pricing.

monitor equipment use and to detect abuse and overuse. Xerox photocopiers, for example, often embed this technology. The concern remains that despite potentially costly electronic monitoring, some portion of problems that would be monitored and corrected by the customer's onsite management is still likely to escape detection by the off-site manufacturer.

6. CONCLUSIONS AND FURTHER RESEARCH

By aligning manufacturers and customers' incentives, servicizing offers many opportunities for companies to work together to achieve greater value at lower cost. This new relationship may provide new opportunities to redesign products to reduce their environmental impacts throughout their lifecycle. Largely, this occurs because servicizing requires manufacturers to internalize some of their products' externalities.

This paper has used transaction cost economics to identify and compare the transaction hazards associated with servicizing with those that accompany typical sales transactions. While servicizing mitigates some transaction hazards featured with asset sales, servicizing creates many new transaction hazards. The success of servicizing relationships will depend on the ability of manufacturers and customers to successfully mitigate the many transaction hazards involved to realize mutual gains over typical sales transactions. This paper has provided a theoretical framework that can be used to begin constructing well-designed contracts.

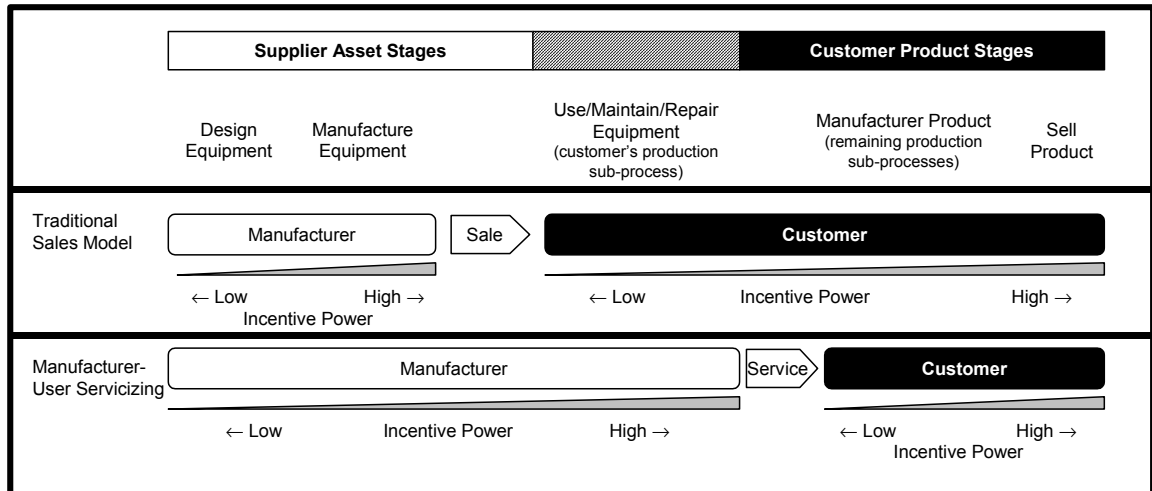
A useful next step in servicizing research would be a detailed review of the contracts that are currently used in actual servicizing transactions to analyze the extent to which the predicted contractual features are present. Interviews with manufacturers and customers engaged in negotiating servicizing contracts would provide insightful to the concerns of each party and to provide the basis to test many of the above propositions.

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Figure 1



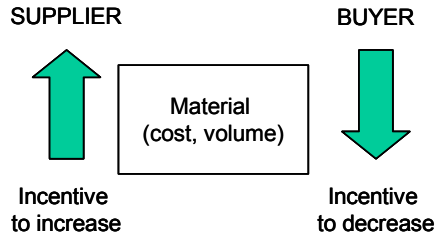
Caption

In the traditional sales model, the manufacturer has high-powered incentives during the manufacturing phase, where its production costs directly influence its profitability. In the servicing model, high-powered incentives are extended to the manufacturer throughout the use/maintenance/repair phase, as costs incurred during this additional phase now also directly influence its profitability.

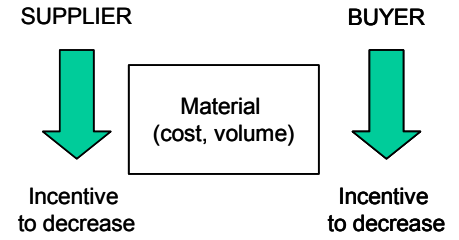
Figure 2

Servicizing aligns incentives

Conflicting incentives of typical sales transactions



Aligned incentives in the servicizing model



Source: Based on Reiskin et al (2000)

Table 1
Key attributes of alternative governance structures

Market	Hierarchy
High powered incentives (reward outputs)	Low powered incentives (reward inputs)
Autonomous control	Administrative control
Legal recourse to resolve disputes	Senior manager resolves disputes
Autonomous adaptation	Coordinated adaptation

Table 2

The party responsibility for each product stage varies across transaction types

	PRODUCT LIFECYCLE STAGE					
	Design & Manufacture	Ownership	Maintenance	Repair	Use product	Redeployment, Reclamation, Disposal
Typical sales transaction	Manufacturer	Customer	Customer or Third Party	Customer or Third Party	Customer	Customer
Manufacturer-User Servicing	Manufacturer	Manufacturer	Manufacturer	Manufacturer	Manufacturer	Manufacturer
Customer-User Servicing	Manufacturer	Manufacturer	Manufacturer	Manufacturer	Customer	Manufacturer

Table 3

Manufacturer and customer priorities differ in servicing and sales transactions

	Sales transactions		Servicizing transactions	
	Manufacturer	Customer	Manufacturer	Customer
Production cost	Low	(Low)*	Low	(Low)*
Purchase price	High	Low	-	-
Repair price (cost)	High	Low	Low	(Low)*
Maintenance costs	-	Low	Low	(Low)*
Ideal units sold (bought)	High	Low	Low	Low

Note: * Indirect objectives are presented in parentheses