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DISSOLVING FIRM BOUNDARIES THROUGH SURVEILLANCE: INCOMPLETE CONTRACTS, INFORMATION ASSETS, AND PROCESS INTEGRATION

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Abstract

This paper addresses the issue of interorganizational governance and process integration. Specifically, we are concerned with IOSs characterized by shared processes, joint control, yet divergent incentive structures. The analysis is inspired by the Grossman, Hart, and Moore theory of incomplete contracting, which forms a framework of vertical and lateral integration based upon residual rights of control over physical assets. In this study, we explore the application of a derivative of this framework, which allows for the separation of physical and information-based assets. As a consequence of this separation, we demonstrate how the acquisition of information can shift the locus of decisions in integrated processes as well as affect pricing and the distribution of rents within a value chain.

The empirical setting is a high-tech manufacturer that implemented a Lotus Notes application which tracks the flow of products across several legal entities within its sales channel. We conduct a simple regression analysis for transactions with one distributor, where we find significance in the price differential for products traded within vs. outside of the system, demonstrating a shift in the distribution of rents via information appropriation. We conclude with a discussion of how a managerial perspective would benefit from viewing supply and value chains that span organizations as single systems, not merely competing agents, and suggest how an incomplete contracts perspective is beneficial to this challenge.

Keywords: Interorganizational systems, incomplete contracts, economic theory.

1. INTRODUCTION

The recent academic interest in what constitutes the “boundary of the firm” articulates a severely delayed response to the seminal work of Coase (1937), who argued that the relative costs of transacting will determine whether companies will choose to conduct activities within their own organization or on the market. The “transaction cost” perspective obtained marked momentum in the 1970s and 1980s, championed by Williamson (1975, 1985), which deems the transaction as the fundamental unit of analysis in the formation of markets and hierarchies. Yet despite the attention received by transaction cost economics (TCE), the theory has not gone unchallenged in its aim to define organizational boundaries. Evolutionary theories (Nelson and Winter 1982) and resource-based theories (Barney 1986; Rumelt 1984; Wernerfelt 1984) offer alternative, economic explanations of the purpose, logic, and mechanisms of firm formation and definition. However, none of these perspectives have independently succeeded in succinctly defining the boundaries of the firm as well as the so-called property rights approach. What we today call incomplete

contracting theory (Grossman and Hart 1986; Hart 1995; Hart and Moore 1990) clearly and crisply defines the firm as a bundle of assets under common ownership, based upon risk bearing and residual rights of control.

In this paper, we make a paradoxical twist to this development. Namely, we show how incomplete contracting theory can be applied to understand the erosion and dissolution of firm boundaries. We do so by applying a specific derivative of incomplete contracting theory, one which explicitly models the role of Information Assets in the formation and metabolism of organizations (Brynjolfsson 1994). As incomplete contracting theory is primarily interested in tangible assets, the introduction of information assets as a concept complicates the conclusions of this highly formal framework. Specifically, information has many characteristics that are not shared by physical assets (e.g., it can be owned concurrently, is reproducible at little marginal cost, etc). In this paper, we focus on one peculiar attribute of information: its “observability.” We are concerned with the possibility of acquiring information assets independent of any commercial transaction, but rather through surveillance. We demonstrate how the “covert” acquisition of data can shift bargaining power and the distribution of rents in a value chain spanning several legal entities, and how this information is used to influence activities far beyond the legal boundaries of the firm, thus eroding, blurring and redefining the organization’s limits in a paradoxical, new way. We further suggest how the framework can be useful in understanding supply and value chains with competing legal entities as single systems.

We begin with a brief introduction to incomplete contracting theory as well as the specific derivative of the framework that accommodates information assets. We thereafter turn to an empirical setting, where we describe the development of a Lotus Notes application designed to monitor a company’s flow of products throughout a sales channel, crossing several legal organizations. We validate the argument that the system is used to increase the company’s bargaining power through a statistical test of the relative price levels of products traded in and outside of the system in parallel. Finally, we conclude with a discussion of the results as well as the research implications for the emerging wave of organizational hybrids which challenge the existing paradigm of the market-hierarchy continuum.

2. THEORETICAL OVERVIEW

In recent years, the theory of incomplete contracting has grown in popularity in both industrial organization as well as the analysis of interorganizational systems (IOS) (Bakos and Brynjolfsson 1993; Bakos and Nault 1997). The theory of incomplete contracting, with origins in transaction cost economics (TCE), was pioneered by Grossman, Hart and Moore (Grossman and Hart 1986; Hart 1995; Hart and Moore 1990). Like TCE, incomplete contract theory views the transaction as the fundamental unit of analysis. However, a critical difference is the assumption of bounded rationality; that is, the assumption that economic actors can not, and do not, foresee and contract for every contingency. In other terms, all “real-world” contracts will somehow be incomplete in that it is either impossible or too expensive to foresee, define, enumerate, and contract upon all circumstances and contingencies which may occur in the future. Accordingly, all rights not expressly defined in the contract accrue to the owner of the “asset” as “residual rights” of ownership. The allocation of these residual rights will have a pivotal effect on the bargaining position of the parties after investing in the contract/relationship. Based upon these roughly described principles, Grossman, Hart and Moore have developed a theory of vertical-lateral integration and market structures.

It is important to note that the Grossman, Hart and Moore framework is largely based upon physical capital, although they don’t explicitly exclude intangible assets. An asset is important in incomplete contracting, insofar as the marginal value of an agent’s actions are increased via access to an asset (Brynjolfsson 1994). This paramount qualification allows us to access interorganizational systems via the perspective of residual rights of ownership of the information asset. However, while the academic community has successfully acknowledged that access to information ownership shifts the locus of decisions and alters incentives within an IOS (Bakos and Nault 1997; Kumar and van Dissel 1996), much of the earlier work in this area lacks a sound theoretical base (Mukhopadhyay, Kukre and Kalathur 1995). Hence, we seek a theoretically motivated attempt to dissect integrated organizations characterized by co-specialized assets, shared processes, and joint control operating under the shadow of divergent incentives. Specifically, we seek an analytical tool in which the modeling of information assets is determinative in these hybrid organization forms.

The inclusion of intangible assets in a theoretical framework that is largely focused upon physical capital presents challenges as additional criteria for analysis. Not only are information assets often reproducible with little marginal cost, they can be owned concurrently, may or may not be alienable, as well have other characteristics which can complicate this formal theory. In the following case, we establish why information does not need to be bought and sold like physical assets, but rather can be observed

through joint process ownership. We demonstrate how the acquisition of information through surveillance can shift the locus of power in a complex system of rivalry and cooperation and discuss how a managerial perspective would benefit from viewing supply or value chains that span organizations as single systems, not merely competing agents.

3. COMPANY BACKGROUND and CONTEXT

ScanNet¹ is a Scandinavian producer of computer networking and communication products and is listed on the NASDAQ as well as a major European stock exchange. Although the company is headquartered in northern Europe, it also maintains several large development facilities in the U.S. in addition to over 30 sales offices the world over. Budgeted revenue and headcount for 1998 is over 300 million USD and 1,500 employees. The company's core technological expertise is in Token-Ring, a networking protocol developed by IBM. However, market forecasts predict declining demand for this platform in the long term. In response, ScanNet has positioned itself to take advantage of growing demand in the lower priced Fast-Ethernet market, and invested heavily in the development of high performance ATM (asynchronous transfer mode) products.

ScanNet's first product lines were NICs (network interface cards); primarily Token-Ring adapter cards for network integrated computers. However, the colossal expansion of networked computing has opened opportunities in networking infrastructure and backbone products. Thus the company is today positioned to offer end-to-end solutions which encompass modems, adapters, cables, hubs, switches, and mobile computing products, seamlessly integrating Token-Ring, Ethernet, and ATM technologies. Major competitors include IBM, Bay Networks, Cisco, and 3Com.

3.1 The Mentality of a Stock-listed Company

Being listed on the stock exchange, in particular the American NASDAQ, creates a certain type of behavior which, when not adequately controlled, can have destructive effects on a company's long term position. In particular, the Anglo-American shareholder wealth maximization paradigm renders stock price the single most dominant measure of the management's ability to successfully operate the company. The share price is particularly sensitive to the company's quarterly results. Not only are the nominal levels of interest, but more importantly, the company's financial results relative to previous public overtures made by the management in the form of pre-closures, budgets, and press releases. All of these factors can influence market expectations, and results that are marginally above or below market anticipations can have far greater effects on the share price than larger, nominal changes, which agree with the disclosed budgets. As a result, there is significant pressure on the management to achieve revenue and net earnings results that do not significantly diverge from market expectations.

3.2 Stuffing the Channel

Needless to say, management is more often than not on the wrong side of this equation. That is, they are behind budget in terms of sales revenue and net earnings. A well known technique for bolstering sales in the final weeks of the quarter is known as "channel stuffing": the practice of offering large, additional discounts to the major distributors who agree to purchase large quantities within the legal end of the fiscal quarter. It is not unusual if 50% of the company's revenue is realized in the final two weeks of a 13 week quarter. Sales managers invariably achieve sales budgets according to expectations. But there are two very harmful symptoms of this practice:

1. Product profitability suffers. The company sells a larger quantity at a lower unit price.
2. The distributors assemble an unnaturally large inventory of the company's products—one that far exceeds the organic demand of the following quarter and, consequently, accumulates.

Thus the immediate consequence is a reduction in profit margin due to quarter-end discounting, but the long-term effects are more severe. The distributors now have an inflated inventory that cannot be completely sold in the next period, making them less willing to order products it otherwise would have purchased under normal circumstances. The channel's "bloated" status gives further reason to offer even greater quarter-end discounts in the following quarter, reinforcing a vicious, addictive spiral.

¹A pseudonym is used at the company's request.

3.3 The Dynamics of the Channel

The “distributor” segment is very competitive, and any source of additional margin is critical. Thus forcing quarter-end discounts is a well-known source of profits for the distributors. As such, distributors are not very willing to offer any information concerning their own holdings of a manufacturer’s products, as it would clearly reduce their bargaining power.

We’ve tried to get them to disclose data on the inventories for a long time, but the channel knows that it would erode their own margins. [ScanNet Planning Manager]

The ScanNet management was quick to realize that an important ingredient in reducing its dependence upon “channel-push” was to increase the demand at the end-user side of the channel. Allocating additional resources on “channel-pull” would improve the natural flow of products through the distributors and Value Added Resellers (VARs).

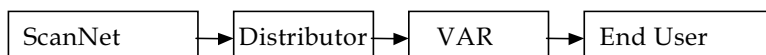


Figure 1a. The Scales Channel

This is a consequence of the complex nature of the sales channel, which is typical of the IT industry by and large. The largest purchasers of ScanNet’s products, aside from OEMs (original equipment manufacturers), which sell under their own brand name,

are the distributors such as Ingram Micro Inc., Tech Data Corp., and Azlan Ltd. The distributors normally sell to end-users through a VAR, who is experienced in the sales and support of complex networking solutions in vertical markets. They typically integrate ScanNet’s products into complex host environments, as well as provide training and support. End users are found predominantly within the banking, insurance, airline, manufacturing, and public sectors. Thus, while there would seem to be little apparent incentive to expend resources on end users, stimulating demand at the final end of the channel is equally, if not more important than pushing products through distributors.

3.4 Divergent Incentives: Joint Processes

As a consequence, a considerable amount of the company’s sales and promotional resources are directed toward end users, although these users are not direct customers of the ScanNet. A typical sales relationship would include a ScanNet representative together with a VAR in order to secure an order from a large customer. This produces an awkward situation, in which two organizations cooperate closely, expending significant resources in order to complete the same process, namely sell products to a particular customer. As noted by a senior manager,

I don’t think our representatives are conscious of the fact that we have a very sensitive pricing issue with our VARs and distributors. The products they help sell have already been introduced to the channel at a set price, so all their attention goes toward generating demand by the end-users. However, on a managerial level, we are clearly aware of this conflict, but are admittedly a little naive about how to manage it. [Sales Director]

4. SYSTEM DESCRIPTION

HawkEye is a proprietary Lotus Notes application designed for the sales and service organization to communicate internally and effectively coordinate promotional activities. Motivated by the company’s desire to better understand the dynamics of demand creation, the heart of the HawkEye system is a distributed database in which all sales and marketing personnel can register client prospects, contacts, promotional activities, and actual sales (the goal was to match and expand the functionality of ACT, a popular sales management software application). The main purpose of the system is to coordinate centrally planned marketing initiatives with local activities, as well as allow different organizational units with the same customer contact to coordinate status and actions. Local data on all clients, prospects, and promotions are collected the world over and are aggregated and centralized once every 24 hours. In this manner, it is possible for personnel at headquarters to know the current status of all accounts to the detail of the last visit, phone call, or letter, as well as any response or feedback received from the prospect. In registering all

promotional activities and customer response, ScanNet could more easily trace sales directly to specific marketing initiatives. This ability improved their understanding of the causal relationships between promotional expenditures and the creation of end-user demand.

Inspiration for HawkEye's development originated in the U.S. subsidiary. Weak sales results, combined with the strong concentration of ScanNet's main, predominantly U.S., competitors had rendered the tendency to push products through the channel all to frequent an occurrence. It was not until the benefits of the system were reasonably demonstrated in the U.S. that it was implemented in the European and Asian sales regions almost two years later.

4.1 Functionality

The HawkEye system supports a number of different views, aggregations, and drill downs. These include views by company, activity, point of contact, evaluations, forecasts, and marketing. End users are established in the system under a company profile. Each company profile has a variety of data dimensions that must be completed, but important to note are "contact person" and "preferred reseller." The preferred reseller field allows HawkEye to trace actual sales back to the reseller, which consequently enables the sale via the VAR/distributor database to be mapped back to the distributor. Hence, end-user sales can be tracked through the VAR to the distributor that purchased the product from ScanNet. In addition, prospects are evaluated as probabilities; that is, the probability of given sale and the probability of a given time period. In this manner, potential sales activity is also incorporated into the aggregated forecasts.

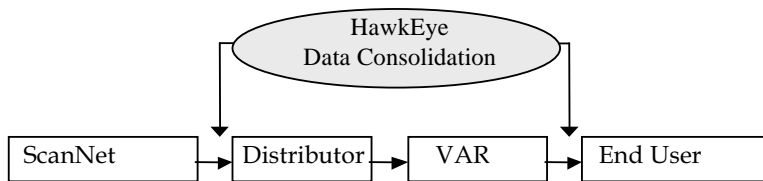


Figure 1b. HawkEye Registration Points

It was purely by accident that ScanNet learned that this function could be used to their benefit. As mentioned, the main purpose of the system was to track and manage promotional activities. Only by coincidence did the management realize that consolidating the data that traced products through distributors and VARS actually made these once opaque customers far more transparent. The ability to interpolate inventory levels of their largest customers per-

mitted sales managers to obtain a much more accurate indication of what the "natural" demand of a particular customer would be, given its historical purchasing and inventory levels. This proved very advantageous when planning the quarterly sales activities to a given distributor and, as such, reduced their tendency to resort to quarter-end discounts to achieve revenue budgets.

5. VALIDATION

Based upon the proposition that the control of information determines the distribution of rents within an interorganizational system, we can capitalize on the fact that the system was implemented far earlier in the U.S. than in Europe. This offers a unique opportunity to study the transaction set of ScanNet and a single, world-wide distributor, eliminating the need to control for differences in purchasing behavior among independent companies. This allows us to test the hypothesis that the acquisition of information has explicit effects on the distribution of rents within the channel, as we can test for a shift in the status in the U.S. revenue, while maintaining the European revenue as a control. Hence we formulate the following hypothesis:

Hypothesis 1. *The acquisition of channel information through the HawkEye system will enable an increase in the price obtained by the manufacturer.*

As a proxy for this effect, we will attempt to isolate a change in the differential between products that are sold within the HawkEye system against products that are not. We are concerned with the differential because the nominal price levels fluctuate considerably and are further compounded by annual price erosion of up to 20%.

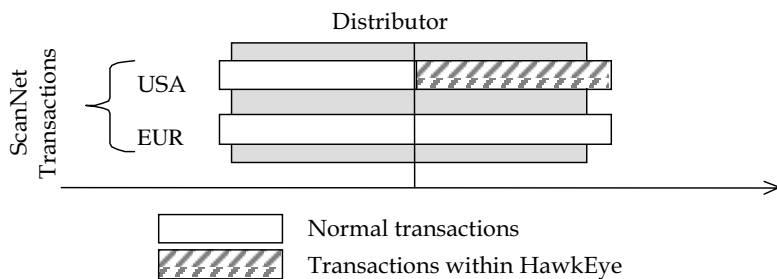


Figure 2. Conceptual Model

ual data points from two sales regions, representing the quarterly average price for the company’s primary product in the respective areas. We have chosen to look at a network interface card (adapter) as it has been the most significant generator of sales activity in terms of revenue, sales units, and transactions. In the instance that one product model is superseded by another, we substitute the “newer” product if and when it assumes the position as the company’s major revenue generator, yet still represents the same product type and technological platform. We are concerned with quarterly average price due to the fact that it is this figure that determines the overall profit levels in the quarterly accounts. It is on this quarterly cycle where quarter-end discounting may be manifested, and upon which the consciousness and behavior of both the company’s management and the distributors are founded.

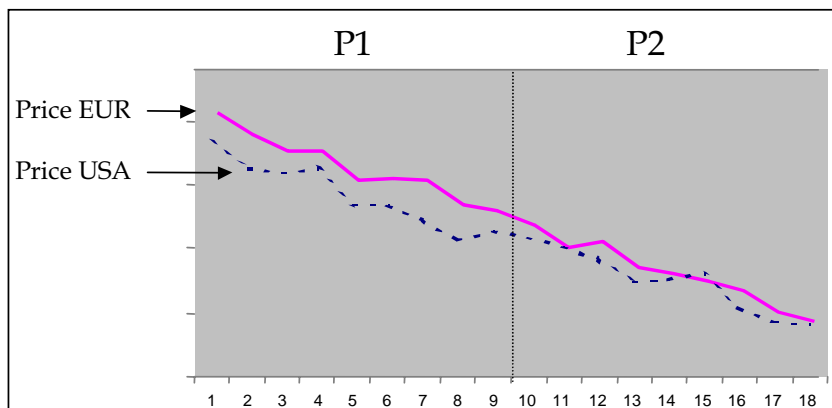


Figure 3. Nominal Price Development

reduction in the price differential from period 1 to period 2. However, to what degree this reduction is the result of the transition from P1 to P2, or another trend within the data, must be tested statistically. Therefore, we test hypothesis 1 with the following model:

$$DIFF = \alpha + \beta_1 \text{QUARTER} + \beta_2 \text{PERIOD} + \epsilon$$

where

- DIFF = the relative difference in the sales price of the products in the two regions. (PriceEUR. - PriceUSA)/ PriceEUR,
- QUARTER is a variable representing the quarter,
- PERIOD is a dummy variable indicating either period 1 or period 2.

This experimental design is portrayed in the conceptual model presented in Figure 2. We assume that any changes in market conditions will be equally expressed in both price levels, as they are manifested in the transaction set of one seller and one buyer.

5.1 Data and Testing

This design permits a parsimonious statistical test, where we regress the price differential against the two time periods. Our data consists of 18 individual

The HawkEye system was officially implemented in the U.S. in September 1995. However, it took several months before technical flaws were resolved and the discipline was sufficient among the sales force to render the information level adequate to maintain that the system could be advantageous to sales planning. Thus, for purposes of this analysis, we conclude that the system was *effectively* operational in Q1, 1996.

The graph in Figure 3 depicts the development in the nominal price levels for the 18 periods. The vertical line represents the U.S.’s transition to the HawkEye system at Q1, 1996. Visually, it is easy to confirm a

F Value	Prob>F	R ²	Adj R ²
7.072	0.0069	0.4853	0.4167

Ind. Variable	β	<i>t</i>	Sig <i>t</i>
INTERCEPT	0.066333	4.609	0.0003
QUARTER	0.001267	0.545	0.5938
PERIOD	-0.056067	-2.325	0.0345

Figure 4. Model Fit

We include the variable QUARTER to control for any other effects which may be independent of the transition between the two periods, that is, an attempt to capture any other trend permeating the entire data set over time.

The results of the regression analysis are presented in Figure 4.² The model fit is statistically significant at the 0.69% level with an R² of 49% and adjusted R² of 42%. The coefficient for PERIOD is statistically significant at

3.4% and a *t* value of -2.325 . Furthermore, the coefficient for QUARTER is not statistically significant, thereby indicating that there is no other substantial trend pervading the data set. The obvious criticism of this model is that it fails to account for any regional differences in economic cycles between Europe and the U.S that could differentiate purchasing patterns, and hence, relative price levels. Nor does it test for other possible explanations. However, we refer to the high R² values as an indication that we have captured a significant proportion of the effect. As such, we find significant support of hypothesis 1.

6. ANALYSIS

We have demonstrated that, in the course of a joint process of sales, distribution, and implementation, ScanNet's representatives were able to appropriate information that was used to obtain an increase in the relative price of the product, supporting the argument that the appropriation of information causes a shift in the distribution of rents.

6.1 Just Information Asymmetries?

However, the mere issue of information asymmetries between channel intermediaries is not exactly novel. In fact, marketing literature has long acknowledged that divergent incentives among channel partners is a significant managerial challenge (Jeuland and Shugan 1983; Moorthy 1987; Spengler 1950). Moreover, situations analogous to the ScanNet case, where the intermediary is better informed of demand conditions than the manufacturer, are typically referred to as the "demand revelation" problem (Desiraju and Moorthy 1997; Myerson 1979). In this instance, the retailer or intermediary can obtain informational rents due to superior knowledge of demand patterns. Hence, the question arises, how and why do we advocate the value of an incomplete contracting perspective in this instance?

The answer lies largely in the acknowledgment that this information was captured as a consequence of joint process ownership, that is "knowledge of time and place" (Hayek 1943, p. 524), or knowledge that is the specific by-product of a productive activity. Our case study documented the company's sphere of influence navigated far beyond the legal boundary, leapfrogging its immediate customer in a linear value chain. This is a novel phenomenon, at least concerning transaction-based theories of the firm, which are typically guilty of atomizing all economic activity in a form of "dyadic reductionism." By this, we mean well-defined points of transacting, where the exchange of physical goods, services, intangibles, revenue, and information clearly and succinctly occur on the interface of two—and only two—organizations. Here a discussion of information asymmetries would be adequate. However, if traditional transaction-based theories can accommodate simple, focused transactions, they break down when confronted with the convoluted interaction we see in many forms of value chains and IOSs.

This is exemplified by ScanNet, where the transaction interface is no longer crisply defined, but rather is diffused over several organizations as a joint process of production, distribution, and implementation. Furthermore, this joint process spans a constellation of legal entities, with divergent incentives manifested in the form of acute price competition. Thus, a managerial

²A detailed description of the regression analysis and alternative tests is available from the author (wareham@cbs.dk).

perspective demands that we no longer discuss what occurs at the edge of “firm boundaries,” but must consider a broader concept of meta-organizations and transaction interfaces, which are dispersed, and firm perimeters, which are porous, grafted, and dissolved.

It is in this end that information asymmetries perspective fails to capture the full implications of ownership, influence, and control that traverse, redefine, and undermine the notion of firm boundaries. Paradoxically, Arrow (1975) suggested that the defining characteristic of internal integration is that information asymmetries are removed within the firm. While his argument is extreme, it is noteworthy that our case offers an ambiguous causal twist to this logic. Namely, it is the participation in a joint process outside the normal domain that permits a reduction in information asymmetries. Appropriation of this information further permits the reduction of asymmetric rents, reducing the bargaining power of agents within the system, which, according to Arrow, is a proxy for the level of internal integration. Hence, the possession or non-possession of information is no longer the primary determinant of firm formation, but also a consequence of other factors. We are, therefore, motivated to turn to a construct that accommodates the influence and ownership of “information” in order to study what drives firms toward “process integration” or joint process ownership.

6.2 What Does the Framework Predict?

While we have a well motivated need, the question remains as to what explanatory or normative guidance a “property rights” perspective can offer in this case. It should be noted that incomplete contracting is relatively new and has not undergone a tremendous amount of rigorous testing. Thus the conclusions we draw are speculative at best, but may offer valuable conceptual guidance in forging future research.

There are two important predictions that are relevant to our case:

- Assets that are highly complementary should be owned by the same party.
- Many complementary assets have increasing returns to scale (synergies) and, consequently, should lead to the formation of larger firms. In other terms, complementarities and synergies lead to a higher level of integration (Hart 1995).

Consistent with our previous argument, these predictions can be made to hold for information assets as well.

The basic message of these predictions is that, in the face of demand uncertainty and relation-specific assets, the optimal solution exists when asset externalities (synergies) are internalized under common ownership. This implicitly mitigates opportunistic behavior through residual rights of control over the assets. In the instance where highly complementary assets are not owned by the same party, the threat of a hold-up problem exists. Thus, there is a clear incentive or natural tendency for parties to seek some degree of internalization to mitigate potential hold-up threats and harness externalities.

When assets are physical, they can be controlled. The question of selling or retaining an asset is the sole jurisdiction of the owner and residual rights of ownership are easily protected. As argued, at the intersection of uncertainty and interdependence, we find a clear force driving divergent parties toward internalization of complementary assets (Abell 1996). But when these complementarities are intangible, their appropriation is not so easily guarded. Residual rights of ownership erode, and the clear concept of “assets under common ownership” is corrupted.

In the ScanNet case, we have argued that knowledge of channel inventory levels is a specific asset needed to ensure the stable flow of products through the channel. When ScanNet did not have access to this information, a hold-up problem existed. A natural response to this situation would be for ScanNet to seek some form of internal integration to help mitigate the hold-up threat. The obvious form of integration is formal ownership. However, it is clear that the company’s relative size prevents any significant legal ownership of even one distributor which could offer the same coverage of its products. Thus the acquisition of stockholders’ equity is not a viable option.

A more discrete manifestation of internalization is “process integration.” Here we mean a level of influence and “process ownership” which defies our traditional understanding of the term “equity” (Konsynski 1993). In ScanNet, we see a form of integration that is very real, yet does not exist in the earlier theories of vertical and lateral integration. Process integration enables them access to highly specific, information assets, ameliorating the hold-up threat from the distributor.

To claim that the pursuit of information to mitigate hold-up threats is the sole driver of process integration is conjectural. Future research should focus on the interaction of “rational agent” theories from the transaction-based tradition and other explanations of industry formation. In fact, it is in the realm of contractual incompleteness where the property rights perspective explicitly permits consideration of alternative social forces and governance mechanisms in institutional formation. However, the process integration phenomenon is becoming more and more prevalent, spawning a wave of interorganizational systems and electronic intermediaries that elude explanation in the market hierarchy continuum. The information assets derivative of the property rights approach is a viable alternative for a research agenda desperately in need of sound theoretical motivation.

7. CONCLUSION

In this paper, we have described an innovative IT application that enabled a manufacturer to increase its bargaining power by interpolating inventory levels within the sales channel. Moreover, through solid empirical grounding, this paper makes two significant contributions to our understanding of IOS governance. First, we demonstrate how information assets can be appropriated through observation in a venue of joint process ownership. We validate the claim by testing the price differentials of products tested within and outside of the system in parallel, confirming that the acquisition of information permitted a reduction of information asymmetries, thus shifting the distribution of rents to the benefit of the manufacturer.

More importantly, however, we have motivated a need to understand the sales and distribution channel as a single system, not merely a chain of competing agents. Specifically, we show how transaction interfaces can be diffuse, porous, and integrated, and therefore warrant a research agenda that examines the drivers and consequences of process integration. In this aim, we have explored the application of the information assets derivative of incomplete contracting theory. By focusing on the complex relationship between uncertainty, interdependence, asset specificity, and synergies, we illustrate the significant potential of the information assets perspective to illuminate the poorly understood metabolism of IOSs and intertwined value chains as they emerge today.

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