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INFORMATION TECHNOLOGY AND INFORMATION GOODS AS PREDICTORS OF ORGANIZATIONAL EXPANSION ACTIVITY¹

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Extended Abstract

This research presents a model that separates the effects of the use of information technology (IT) in the production and distribution of goods from the degree of information in the product on changes in vertical and horizontal firm boundaries. The research tests and confirms the hypothesis that firms that produce higher levels of information goods tend to have different vertical and horizontal organizational boundaries when compared to non-information goods firms. Information goods producing firms may be subject to unusual economies of scale, scope, network externalities, and increasing returns effects. These effects are drivers for horizontal firm boundary expansion. Further, the research partially tests the electronic markets hypothesis, which argues that information technology influences the dismantling of extensive vertical firm boundaries by lowering firm transactions costs, finding some supportive results. The research also tests for the hypothesized effect of information technology use in enabling expanding horizontal firm boundaries. Chi square and MANOVA analyses, using two years of merger, acquisition and alliance event data on a sample of 317 very large firms were conducted, while controlling for firm revenues. The results suggest that information goods producing firms have structures that are driven by the unique economics of manufacturing and marketing information products, as well as the transactional and agency effects of information technology used in production.

The electronic markets hypothesis (EMH) holds that information technology (IT) use will influence the dismantling of fixed vertical firm boundaries by reducing the transaction cost for the acquisition of input goods between firms. The EMH predicts a rise in electronically coordinated vertical markets as a result of information technology deployment. An evolution toward electronic markets will first be empirically evident via increases in network alliance agreements between vertically allied kinds of firms (Malone et al. 1987).

Yet, anecdotal evidence of intense vertical and horizontal merger and alliance activity for information goods producing firms seems to be only partially explained by EMH predictions of an IT-driven rise in electronic vertical market coordination structures. This research model separates the economic effects of a firm's *expenditures on information technology* on the internal governance of the production and distribution sequence (vertical organizational boundaries) and external market structures (horizontal organizational boundaries), from the economic effects of the *degree of information in the firm's product line*. Here, a firm's vertical boundary refers to the depth of firm ownership of the sequential production value chain, from raw inputs to final distribution and service. A firm's horizontal boundary refers to the characteristics of the firm ownership of the product marketing channel, both in terms of product line offerings within a single market and breadth of product coverage by a firm across

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geographic markets. The dependent constructs represent the organizational boundary expansion of the firm in either a vertical or horizontal dimension, controlled for firm size based on revenue.

The central thesis of the study is that highly information goods intensive producers are more likely to be shifting to deeply integrated vertical hierarchies, evident through either vertical mergers or alliances, along with displaying increased horizontal monopolistic and/or conglomerate boundary expansion activities, evident through either horizontal mergers or alliances, as compared to less intensive information goods producers.

The study also explores transaction cost predictions regarding post-IT reductions in formal vertical organizational boundaries (the EMH). The research examines the role of information technology in reducing agency costs, as would be evidenced by increased horizontal expansion for those firms with high levels of information technology. The independent constructs represent the information intensity of the firm in terms of its products and its overall spending on IT.

Two years of horizontally and vertically coded event study merger and alliance data for 317 of the 1,085 largest, publicly traded, U.S. headquartered firms indicate that the model and some of the research hypotheses are supported. Four expert coders used product sales information and the North American Industry Classification System (NAICS) taxonomy of the information goods industry to reliably define the information goods production intensity of the firm, with a Cronbach's alpha of 0.96. Reliable and valid 1994 IT expenditures were obtained from a Computerworld, Inc. survey, which dictated the research sample. All horizontal and vertical alliances and merger announcements appearing in the *Wall Street Journal* for the sample for the lagged years 1995 and 1996 were coded by two experts using Department of Justice legal guidelines in a three stage process, with an interrater reliability of no lower than 0.84 for any of the three processes. There were 936 horizontal alliances across 161 firms, and 645 horizontal mergers for 196 firms. For the 317 firms, 19 vertical mergers were reported for 12 firms, and there were 102 vertical alliances for 31 firms.

Support for the research model indicates that the information goods intense producing firm organizational boundary structures may be guided by horizontal drivers (unique economies of scale and scope, network externalities, and increasing returns associated with the large-scale production, distribution, and marketing of information products), as well as vertical drivers (the transactional effects of IT in the production value chain). Firms that are dominant information goods producers are more likely to enter into alliances both horizontally and vertically at all levels of information technology, as compared to non-information goods intense producers, when controlling for firm size. This significant relationship of information goods firm to vertical alliances may be indicative of alliance formation designed to alleviate higher transaction costs of the inputs to production for these kinds of firms.

Further, the research lends weak support to the EMH, finding that differing levels of information technology expenditure have different effects on the formation of vertical alliances. There was a significant, main effect difference between high IT firms and low IT firms in the formation of firm vertical alliances when controlled for sales. This result may offer some confirmation to the EMH hypothesis, indicating that it is possible that firms are using IT to assist in the shift from hierarchies to markets by way of vertical alliances, for the acquisition of production inputs. This effect, however, is not conclusive because the best measure of evidence of the EMH is decreased in mergers.

The EMH does not explain or predict *horizontal electronic markets*. Yet, these findings show that IT has a positive role in the formation of vertical network alliances, and may also encourage horizontal network alliances in lieu of horizontal mergers. There was a significant, main effect difference for higher levels of IT for increased numbers of horizontal alliances, controlled for sales. An interesting result was that higher levels of IT had a significant main effect difference for lower levels of horizontal mergers, controlled for sales. Furthermore, when firms were high information goods producers, firms with higher amounts of IT were less likely to enter into horizontal mergers than firms with low IT. These unusual results imply that IT may have some influence on horizontal expansion by reducing search costs and horizontal coordination costs by enabling network alliances between firms. IT may contribute to mechanizing horizontal markets by lowering customer search costs and reducing information asymmetry, and these horizontal markets may appear first as alliances before they are consolidated into fully neutral horizontal electronic markets. IT also may influence the reduction of firm external coordination costs, such as transportation costs, yielding a capability to better control larger firms in a horizontal sense (Gurbaxani and Whang 1991).

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