



Impacts of internal and interorganizational information systems on the outsourcing of manufacturing

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ARTICLE INFO

Article history:

Received 7 March 2008

Accepted 11 February 2010

Available online 9 March 2010

Keywords:

Interorganizational information systems

Internal IT

Outsourcing

Markets

Hierarchies

Build-to-order

Customization

Transaction cost

Internet

Procurement

ABSTRACT

Drawing on transaction cost economics, this paper looks at the relationship of IT use to the outsourcing of manufacturing using survey data from US manufacturers. We find that greater use of interorganizational systems (IOS) is associated with greater outsourcing, but we do not find any main effects between internal IT and outsourcing. A negative interaction effect is found between measures of internal IT and IOS, suggesting that the two may be substitutes rather than complements. This distinction between internal IT and IOS, and the relationship of the two, offers scholars a more nuanced understanding of the nature and impacts of IT. It provides managers insight into how different types of IT can support different sourcing options.

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1. Introduction

Recent years have seen a decrease in vertical integration in manufacturing, exemplified by the rapid growth in outsourcing to outside contractors (Bardhan et al., 2006; Marchant and Kumar, 2005; Sturgeon, 2002). This has been accompanied by the widespread adoption of techniques such as build-to-order production and lean manufacturing in industries such as computers (Dedrick and Kraemer, 2005), clothing (Abernathy et al., 1999), and automobiles (Holweg et al., 2005; Sharif et al., 2007). These changes likewise have been accompanied by the adoption by manufacturers of information technologies such as enterprise information systems and operations management systems (Bardhan et al., 2007), as well as interorganizational systems (IOS) aimed at improving coordination with external partners (Teo et al., 2003; Malhotra et al., 2005; Brews and Tucci, 2004; Son et al., 2008). The fact that these trends have occurred together raises the question of whether the use of IT and the adoption of new manufacturing practices are related to the increased use of outsourced manufacturing.

Manufacturing firms have increased outsourcing to focus on core competencies, increase production flexibility and improve quality, but the main reason is to reduce cost (Bardhan et al., 2006), as outsourcing specialists can focus on operational efficiency and attain economies of scale by producing for multiple customers. Competition among outsourcing suppliers also drives down costs to clients. Hence, reducing vertical integration through outsourcing is expected to improve firm performance. Research in the computer industry has found empirical evidence that greater vertical integration is associated with

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lower performance (Peyrefitte and Golden, 2004) but others have found that an optimal mix of vertical integration and strategic outsourcing can lead to better performance (Rothaermel et al., 2006).

There are costs associated with market transactions that can nullify the gains from outsourcing, including the costs of searching for suppliers, negotiating and contracting with suppliers, and monitoring performance (Williamson, 1975). Information technology can reduce transaction costs associated with external sourcing, especially search and monitoring costs, thus favoring greater use of markets (Malone et al., 1987; Bardhan et al., 2006). On the other hand, IT can reduce the cost of coordinating production internally as well, making production within the firm's hierarchy more competitive (Gurbaxani and Whang, 1991). Recent research has found evidence that the impact of IT on vertical integration is dependent on industry characteristics, particularly industry concentration and demand uncertainty (Ray et al., 2009), and on the relationship specificity of the IT employed (Kim and Mahoney, 2006).

We seek to understand the relationship of IT to the organization of activities in markets versus hierarchies by studying the outsourcing of manufacturing in a dynamic environment in which IT use is growing and changing, and new manufacturing techniques are being adopted. To do so, we develop a set of hypotheses based on the literature and on field research in the personal computer industry. We test our hypotheses through quantitative analysis of data from a survey of 297 manufacturing companies in the US.

We extend theory and contribute to the IS literature by distinguishing between internal IT and IOS and hypothesizing different impacts for each. While Bardhan et al. (2007) found different impacts for two types of internal IT on manufacturing outsourcing (enterprise management and operations management systems), and Kim and Mahoney (2006) find that the impacts of IT on vertical integration depend on its relationship specificity, ours is the first study we are aware of to study the different impacts of internal IT and IOS on outsourcing.

This study also has important practical implications. There is evidence that outsourcing can lower costs and improve quality for manufacturing firms (Bardhan et al., 2006), yet coordinating production outside the firm's boundaries remains a challenge. The potential for IT to enable more effective use of outsourcing (or conversely to make internal production more competitive) thus has important implications for sourcing strategies. This study also is important in understanding the potential for IT to reduce transaction costs within the supply chain. These implications are discussed more fully in Section 8.

2. Theory

The theory most widely employed in studies of IT and the organization of economic activities is transaction cost economics (TCE). TCE theory states that firms organize transactions within markets or hierarchies to economize on the sum of production and transaction or coordination costs (Williamson, 1975, 1981).¹ Transaction costs are associated with asset specificity, uncertainty and complexity of transactions, and with the bounded rationality and opportunism of individuals. As transaction costs go up, firms are more likely to internalize transactions rather than use markets.

It has been argued that IT use can reduce transaction costs and will lead to greater reliance on market transactions rather than internal hierarchies (Malone et al., 1987; Wigand et al., 1997). One reason is that IT can reduce the asset specificity of investments, for instance, by making manufacturing equipment more flexible (Clemons et al., 1993). Another is that IT can reduce complexity by allowing more data to be processed and communicated readily (Malone et al., 1987). In addition, IT enables better monitoring of outside partners, reducing the risk of opportunism associated with market transactions (Clemons et al., 1993).

A less deterministic argument is that IT does not inherently favor markets or hierarchies, but that its impacts depend on whether IT leads to greater reduction in internal or external costs (Bakos and Treacy, 1986; Gurbaxani and Whang, 1991; Hitt, 1999; Afuah, 2003). IT can reduce external transaction costs but also can reduce internal transaction costs associated with monitoring employee performance, coordinating work across different units within the firm, and providing information to decision makers. If external costs are reduced more, the result will be more use of markets; if internal costs are reduced more, the result will be more use of hierarchies.

Only limited empirical research has tested these theorized relationships of IT to sourcing decisions. In these studies, higher levels of IT investment are associated with decreased firm size (Brynjolfsson et al., 1994) and also with lower levels of vertical integration, but also with increases in horizontal diversification, suggesting that IT enables internal coordination of a complex mix of activities (Dewan et al., 1998; Hitt, 1999). This is consistent with the argument that IT can reduce both external and internal coordination costs (Gurbaxani and Whang, 1991). Other research has found that firms' depth of inter-networking is positively related to greater specialization, reduced hierarchy, and greater external partnering (Brews and Tucci, 2004).

Research on the impacts of IT on the organization of manufacturing found a strong relationship between levels of IT investment and outsourcing of production activities in US manufacturers (Bardhan et al., 2006). Other empirical research has found that the use of electronic procurement is associated with buying from more suppliers for custom goods but fewer suppliers for commodity goods, supporting the argument that the impact of IT depends on the nature of the goods being transacted (Dedrick et al., 2008). Grover and Saeed (2007) find that the use of electronic data interchange (EDI) by electronics manufacturers with component suppliers is higher when component complexity is greater, market fragmentation is low, and

¹ As in much of the literature, we use "transaction" and "coordination" costs interchangeably.

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