PRODUCT SEQUENCING, KNOWLEDGE, AND E-COMMERCE

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INTRODUCTION

The product sequencing model in our original article links the evolution of knowledge to new product introductions over time in technology intensive or operationally complex organizations. As such, we can use the model to help us understand some of the potential benefits as well as possible limitations of perhaps the most exciting new businesses today—those involved in the emerging digital economy (U.S. Department of Commerce, 2000).

The digital economy spans a wide range of businesses and services. Here we focus on electronic commerce on the Internet, defined as purchases and sales of goods and services transacted over the Internet. Two primary forms of electronic commerce involve business-to-consumer and business-to-business transactions. In what follows, we use the product sequencing model to analyze well publicized examples of each of these forms of business. The Internet businesses on which we focus—retail sales and mass customization (business-to-consumer) and electronic buyer-supplier online marketplaces (business-to-business)—are still in the early stages of their development. Like all other aspects of electronic commerce and the digital economy more generally, it is difficult to predict the ultimate form that these businesses will take. We can, however, use the product sequencing model to track the evolution of these businesses, to understand the nature of the knowledge required for the current visions of these businesses, and to analyze how firms may be able to use this knowledge to create new products and services over time.

BUSINESS-TO-CONSUMER ELECTRONIC COMMERCE

Internet Retailers

Well-known examples of business-to-consumer retailers include those such as Amazon or Barnes and Noble (Ghemawat and Baird, 1998) that sell retail products directly to consumers over the Internet. These retailers include start-up companies that began life as Internet companies, as well as established "bricks-and-mortar" and catalogue mail order retailers that added Internet retail stores to their existing businesses. As discussed in our original article, like all retailers, the core knowledge of these companies relates specifically to retail sales, e.g., knowledge related to the mix of products desired by consumers. Integrative knowledge for these Internet businesses links the retailer to its suppliers and customers, conceptually similar to the integrative knowledge employed by Wal-Mart (Bradley and Ghemawat, 1995) in the example in our article.

Like Wal-Mart, Internet retailers may find integrative knowledge helpful to incremental learning related to core knowledge about retail sales, because integrative knowledge enables retailers to obtain feedback about customer buying patterns. Compared to bricks-and-mortar retailers, Internet retailers can more easily obtain information about the buying habits of individual customers, which the companies can then use to do more targeted selling and thus improve the "product" of retail sales. In order to capitalize on the potential of the Internet in this manner, existing bricks-and-mortar and catalogue mail order companies need to alter their integrative knowledge, via either incremental or step function learning. Start-up Internet retailers face at least an

equally challenging task. Since the companies are starting from scratch, they require step function learning in both core knowledge and integrative knowledge.

Mass Customization

Another example of business-to-consumer electronic commerce involves mass customization, such as that pioneered by Dell Computer (Rangan and Bell, 1998). In mass customization, customers configure their own products from among a set menu of modular choices offered by the seller. Dell, which made its name as a mail order personal computer company engaged in mass customization, provides an example of moving mail order business to the Internet.[1]

A company like Dell is both a retailer and a producer. Like other Internet retailers, mass customizers can use integrative knowledge to obtain feedback from customers via purchasing patterns. For example, the companies can see trends in customer demand for product features, and can further use this information to experiment by offering new product features to customers. Here again, integrative knowledge is helpful for learning related to core knowledge about the nature of the product, and for product sequencing based on this learning. In addition, established companies such as Dell need to alter their integrative knowledge, via incremental or step function learning, in order to move their current operations to the Internet. Start-up mass customizers must build both core and integrative knowledge simultaneously.

[1] In addition to sales to individuals, Dell sells directly to businesses. Although the latter portion of Dell's sales over the Internet is sometimes termed business-to-business e-commerce, it has some similar implications for knowledge and product sequencing as do Dell's mass customization sales to individuals over the Internet.

BUSINESS-TO-BUSINESS ELECTRONIC COMMERCE

One of the most talked about forms of business-to-business electronic commerce on the Internet involves the formation of online marketplaces by consortia of buyers, often large established companies in a particular industry such as automobiles, chemicals, or retailing (U. S. Department of Commerce, 2000). These buyers intend to use the Internet to purchase inputs from suppliers, who will bid to supply the inputs.[2] We can think of these planned online marketplaces as performing a similar function to electronic data interchange (EDI) systems that individual companies maintain to link themselves to their suppliers, such as the internal system employed by Wal-Mart.[3] Like EDI systems, online exchanges are best suited to commodities or to inputs that have codified designs, because the required attributes of the inputs can be completely and accurately specified using electronic communication.

In order to develop and utilize these online exchanges effectively, the buyers in these networks need to develop new integrative knowledge, both within the company itself and within any new entity that manages the exchange. This may involve step function learning in integrative knowledge in order to take advantage of the large cost reductions that are foreseen using the Internet relative to EDI networks (U.S. Department of Commerce, 2000). Utilization of these online marketplaces to purchase standardized inputs, however, does not by itself create the potential for product sequencing by the purchasers over time. In order to provide a basis for development of new products by the

[2] Concerns have been raised about the potential for firms to use business-to-business electronic marketplaces to reduce competition (U. S. Department of Commerce, 2000; Federal Trade Commission, 2000).

[3] In fact, most of the current business-to-business electronic commerce takes place over private EDI networks (U.S. Department of Commerce, 2000).

buyers in these networks, the exchanges must incorporate feedback from suppliers or customers in a way that affects the core knowledge underlying the end products (e.g., chemicals, automobiles).

As an illustration of the potential for feedback from suppliers in these networks, suppose the auto companies make computer aided designs (CAD) for parts available on these exchanges. If an entire network of actual and potential suppliers had easy access on the Internet to the whole set of designs that comprise a product, such as a car for example, these suppliers might be able to provide valuable advice to the producer. Such advice might involve improvements in how various parts could be made to fit together better, and how the designs for individual parts could be improved as well. This is just one example of the potential of these exchanges to alter the core knowledge underlying products. As another example, suppose the exchanges could include links to consumers, such as Wal-Mart does using its electronic data interchange. Again, companies could use feedback from their customers as the basis for learning in core knowledge and for development of new products.

CONCLUSION

The foregoing examples of electronic commerce on the Internet indicate ways in which companies in both the business-to-business and business-to-consumer segments of the market can take advantage of opportunities for development of new knowledge and for product sequencing over time. We examined only a few prominent examples. There are many other forms of business emerging on the Internet, and we really have little idea of how these and other yet unknown businesses will evolve over time. But we can use

the product sequencing model to illuminate where some of the challenges lie, especially with regard to development of new knowledge, and where the potential lies for product sequencing. More generally, we did not require an entirely new model to analyze the changes taking hold in e-commerce. And like the e-commerce examples briefly analyzed here, the product sequencing model applies equally well to other businesses involved in the digital economy, including the many technology intensive business that provide the products and services that comprise the infrastructure underlying the Internet.

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