New IT Architecture: Implications and Market Structure

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New IT Architecture: Implications and Market Structure - Extended Abstract -

The development of on-demand computing and Web Services has marked a new IT architecture characterized by plug-and-play, a la carte service and the shift of fixed cost into variable cost computing. This new IT architecture is termed by Hagel III and Brown (2001) as "Your Next IT Strategy" and is believed to be the third major revolution in the IT world, after mainframes and the Internet (Hamm, 2003). The *Web services architecture*, constructed on the Internet, promises to achieve interoperability and integration between disparate (or incompatible) software applications and systems with an open and modular approach. Together with web services architecture, *on-demand computing* allows companies to pay for the functionality as needed—from data storage, computing power, specific applications to other special IT services—similar to the way electricity is purchased.

The new IT architecture differs from traditional IT architecture in that firms do not have to buy their own computers, software applications, data storage devices and networks, nor do they have to build and maintain their internal systems or spend a lot of time and money trying to deal with a mishmash of incompatible systems, due to the piecemeal technology purchases over time, and keeping them up and running. This offers several advantages over the traditional IT architecture. First, it not only significantly reduces investments in IT assets, but also reduces the need for hiring IT staff due to the shift of responsibility for maintaining systems to outside providers, both of which can free firms from huge fixed costs required to run a business. Second, it reduces the setup time dramatically and brings flexibility with a firm's capacity level, allowing firms to adapt quickly to changes in the marketplace. Faster cycle time and being responsive are important factors that drive firms to adopt outsourcing (Apte and Mason, 1995).

This new computing concept resonates particularly well for small businesses since it provides a way of getting capabilities and agility that is too expensive or too difficult get otherwise. For bigger firms, this new business model also allows them to "leverage the best, and outsource the rest", without having to worry about issues typically associated with traditional outsourcing arrangement. Traditional outsourcing arrangement usually involves a fixed payment for a specific amount of output during a usually long contract period. The new computing paradigm distinguishes itself from traditional production technology and outsourcing in that, contrary to traditional outsourcing arrangements, which may be better described as a hierarchical relationship (Gurbaxani and Whang, 1991), the kind of outsourcing based on the new computing concept is toward a market-based relationship, with which, customers are not locked into a technology or a contractor for an extended time, rather, they can pay on a per-usage and per-module basis. The standardized and pay-as-you-go nature of the new IT architecture reduces the concerns of lock-in and potential hold-up by the contractor, one of the most serious concerns for outsourcing, and thus makes the idea of variable-cost computing more attractive and makes it's feasible to have a marketplace for processing power and a la carte IT service. Indeed, more and more firms, including American Express Co., Saks and Goodyear etc., find this new business model of pay-as-you-go attractive and have started to embrace it.

Foreseeing a potential big market for this new outsourcing arrangement in a pay-as-you-go fashion, many big players in the market have made great efforts in formulating their web services strategies to provide a platform capable of supporting different applications and systems, and made massive investments in the necessary infrastructure for the new IT architecture to work. For example, IBM is pushing a new strategy called "e-business on demand" to advance the complete concept of this new computing concept. Microsoft also greatly promotes its ".Net" strategy; Sun advocates "open network environment" while oracle referred to its strategy as "network services". Computer Associates and HP

also quickly jumps in the boat by announcing their plans of "On-demand Computing" and "Adaptive Enterprise", respectively. Albeit different names, the goal of these strategies is that companies will in the future buy their information technologies as services provided over the Internet rather than owing and maintaining all their own hardware and software (Hagel III and Brown, 2001).

The new IT architecture, powered by the development of web services architecture and on-demand computing, offers a new business model for a firm to do business--in the form of variable-cost computing, in contrast with the fixed cost computing with traditional production technology or business model. We are interested in studying how the availability of this new IT architecture may impact firm strategy and market structure. In specific, we seek to address the following research questions: *1. How does the presence of this new IT architecture affect the market structure of the industries that might benefit from it? 2. What's the impact of this technology on pricing and technology choice of the companies in the market? 3. What's the welfare implication?*

Our results suggest that market type and cost structure of the technologies are important factors in understanding the impact of the new technology and determining the market structure. In markets where products may be considered as perfect substitutes, we show that with the presence of the new technology for production, the monopoly power of the incumbent can be greatly eroded, and the new technology may result in a perfect competitive market under very general conditions. We also find conditions where the traditional production technology may be replaced by the new IT architecture. In addition, we find that when the capacity level associated with traditional production technology is high, only one technology may be adopted in the market. Overall, our results indicate that the new computing paradigm is welfare-enhancing, with the increasing social welfare coming from two sources: from market expansion (due to lower prices charged by firms) and from creation of new markets. Consumer surplus also increases with the new technology due to lower prices charged by firms.

For markets that sell differentiated products, we find that when the fixed cost associated with the traditional technology is high, there is always entry with the variable cost technology and the incumbent will also drop the traditional business model and adopt the new business model, suggesting the new technology may have higher impact on markets that are previously monopolized. Most interestingly, the profit level of the incumbent can increase even though there is competition due to the availability of the new IT architecture. When the entry barrier is at a lower level, the market is characterized with two firms both adopting the fixed cost technology when it is the only choice. But when new technology becomes available, interestingly, firms may change their technology choice. Moreover, under some conditions, firms may end up adopting different technologies, resulting in equilibrium with asymmetric firms. In addition, we find that consumer surplus can actually go down with the introduction of the new technology when we have differentiated goods in the market. This is because firms actually pass, all or a part, of the variable cost to the customers when they use the new technology, while firms would absorb the cost in the case of fixed cost technology. So contrary to the markets with homogeneous products, where the new computing paradigm can erode all the market power a firm may have, the new business model may help firms in enhancing their profitability at the expenses of the consumers in markets with heterogeneous products.