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# A Structural Model of Switching Costs in High-Technology Market

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# 첨단기술시장에서 전환비용의 구조모형

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## ABSTRACT

During the last decade, research on consumer behavior in high-technology markets has become an important part of marketing literature. Among the many factors that encourage commitment to a particular technology, one that has received scholarly attention in other contexts is switching costs. Main focus of this study is on the factors that influence whether consumers will switch to alternative technologies or stay with an incumbent technology. The study presents a conceptual framework and develops research propositions for the antecedent variables and consequence of technology switching costs in high-technology market.

**Key Words** : Switching Costs, Technology Commitment, High-Technology Market.

## Ⅰ. Introduction

In the fast-changing and competitive technology market, every firm tries to provide the most advanced version of whatever product they offer. In the computer software market in particular, companies regularly update and upgrade their products in order to encourage a commitment to the technology the repeated purchase or continuous use of a particular type of technology on the part of current users, as well as to entice new users. Alternatively, the complexity that consumers face when making decisions about which technology to use stems to a large degree from the rapid pace at which technology has advanced and the variety of technology alternatives(Bourgeois and Eisenhardt, 1988; Ryuter et al., 2001; Tushman and Anderson, 1986).

Among the many factors that encourage commitment to a particular technology, one that has received scholarly attention in other contexts is switching costs. 'Switching costs' are the psychological, physical, and economic costs that consumers face in switching between technologies (Jackson, 1985). As competition intensifies and the costs of attracting new customers increase,

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companies are increasingly focusing their strategic efforts on retaining customers(Jones et al., 2000). Obviously, a key component in any customer retention program is satisfaction(Cronin and Taylor, 1992). However, satisfaction need not be the only strategy(Fornell, 1992). Barriers to customer defection, such as the development of strong interpersonal relationships or the imposition of switching costs, represent additional retention strategies. Despite their potential importance in the retention process, the role of switching costs has received relatively little attention in the field of marketing(Anderson, 1994; Jones et al., 2000, 2002).

Therefore, main focus of this study is on the factors that influence whether consumers will switch to alternative technologies or stay with an incumbent technology. The study focus on three categories of factors: (1) compatibility with complementary technology (2) pace of technological change, and (3) the consumer's expertise in technology.

The study argues that the success of these seemingly disparate strategies actually depends to a significant degree on the same underlying factor, i.e., switching costs. Further, uncertainty caused by the consumer's lack of expertise also can play a major role in the decision to commitment to a technology. In the process, the study hope to provide an integrative framework for understanding at least some of the mechanisms by which technology advancement strategies and the consumer's technology expertise of the consumer affect technology commitment decisions. The study presents a conceptual framework in Figure 1 and develops research propositions for the antecedent variables and consequence of technology switching costs in high-technology market.

## II. Conceptual Framework

### 2.1. Compatibility of Complementary Technologies

Many of the products are used not in isolation

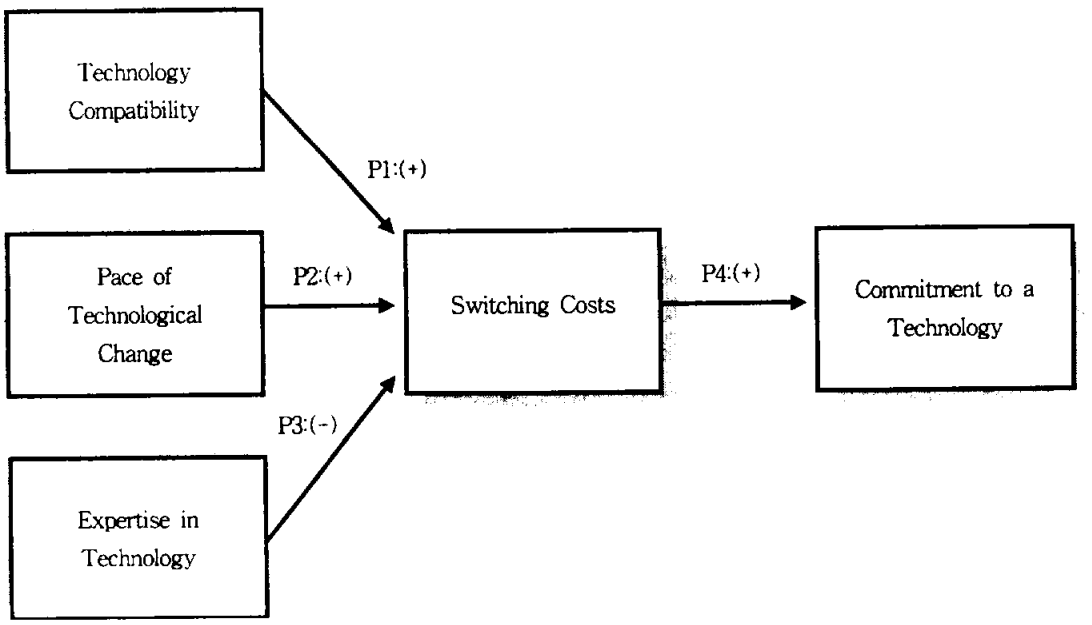


Fig. 1. A structural model of switching costs in high-technology market

but integrated with one or more complementary products. The value of products and services depends on the number or variety of compatible complementary goods or services(Katz and Shapiro, 1985). For instance, CD players are used with CDs, video game consoles with video games, and computer operating systems with software programs. All of these have one thing in common, namely coexistence: they need each other. Consumers are more likely to purchase items that are either compatible with their existing equipment or likely to be compatible with future products in the same category. When consumers purchase products in the form of components that must be put together, technological compatibility between components becomes a factor in the evaluation of the end product(Kotabe et al., 1996).

Alternatively, compatibility of technology is associated with the cost to the consumer of switching technologies. Complementary goods provide system benefits: the added value to users of the full system. The incremental benefits provided by the whole can be greater than the sum of the benefits of the individual components. System benefits usually increase switching costs(Jackson, 1985; Shapiro and Varian, 1999). Therefore, system benefits and the increased cost of switching between whole systems are effective in keeping consumers committed to the technologies they are currently using.

Getting a multicomponent system to work properly almost always requires more than just placing the individual components next to each other. To use the products effectively, consumers must define interfaces, make connections, establish compatibility and invest in other system components as well, and this investment can exceed the investment in the product itself. A study conducted by the Gartner Group Inc. states The initial purchase price of a corporate personal computer accounts for only 10 percent of its lifetime cost. The rest: troubleshooting, administration, software, and training(Gross and Coy, 1995).

To the extent that the existing-version adopter continues to derive a satisfactory consumption value from the entire system and to the extent that the consumer's systemwide investment(in complementary products, interfaces and learning) is neither transferable to the new version nor recoverable from the disposal of the existing version, the consumer will be even more reluctant to switch(Dhebar, 1996). Switching costs in the networked multicomponent system are likely to be larger than stand-alone products, especially when each component in multicomponent system has a different useful lifetime. Therefore,

**Proposition** 1: The existence of compatible complementary products will be positively associated with the costs of switching from an incumbent technology.

## 2.2. Pace of Technological Change

High-technology environments are of particular interest to practitioners and scholars alike because their higher rates of change result in greater technological heterogeneity, and because of the implications of increasing uncertainty(Glazer, 1991). In light of the fast-changing and competitive high-technology markets, a particular type of technology would become obsolete very quickly, with implications for marketing strategies and for the evaluation of vendor performance across time or using criteria sensitive to changes in technology (Smith et al., 1999).

The pace of technological change is defined as the rate at which the focal technology and its features are changing(Weiss and Heide, 1993). In

recent times, the time interval between successive generations of high technology products has been very short. An extreme example of this is the computer software industry, where firms introduce a series of upgrades at a rapid pace. A prominent case in this sector is Microsoft Corporation which introduces upgrades for its operating system Windows approximately once every two years.

In a general sense, the perception of a rapid pace of technological change creates uncertainty (Aldrich, 1979) and gives rise to an information processing problem in potential buyers. Specifically, under rapidly changing technological conditions, acquired information is time sensitive and tends to have a shorter shelf life(Eisenhardt, 1989). That is, to the extent that the technology's features or underlying technology is improving quickly, information about a product received today may be relatively less valuable tomorrow. For a consumer, one implication of the rapid pace in technological change may be a perception that new information may rapidly become outdated anyway. This perception acts as an incentive to consumers to curtail decision processes and to act on acquired information(Glazer, 1991; Weiss and Heide, 1993).

As suggested by Sutton, Eisenhardt, and Jucker (1986), rapid changes in technology make it difficult for buyers to evaluate acquired information in terms of the significance of new technology offerings. This, in turn, gives consumers an incentive to stay with the incumbent technology, even after having collected information about new ones. This prediction is also supported by studies showing that rapid change represents uncertainty because of the time sensitivity of information (Bourgeois and Eisenhardt, 1988). Under such conditions, information gathered at a particular point in time may not remain relevant for long: thus making a decision to buy a new and relatively unknown technology introduces the risk of obsolescence(Eisenhardt, 1989). Consumers are reluctant to switch not because they do not value the improvement, but because early in the life of the existing version, the benefits from switching are not commensurate with the costs of switching (Dhebar, 1996). Hence,

**Proposition 2**: The more rapid consumers perceive the pace of technological change to be, the higher their switching costs.

### 2.3. Expertise in Technology

Alba and Hutchinson(1987) define consumer expertise as the ability to perform product-related tasks and to delineate characteristic differences between expert and novice consumers. As compared to novices, experts are better able to recognize the complexities in a problem and to process information analytically. In a decision to purchase, experts recognize important product attributes, operate from better-established decision criteria, and thus are more capable of making decisions independently. Novice consumers, on the other hand, lack knowledge base or well-formulated decision criteria.

Consumers with less knowledge use less information in their product evaluation process and are less competent to process it. They use fewer quality cues and, as a result, tend to rely on word-of-mouth information rather then on product information. Consumers with more prior knowledge will analyze attributes of quality, beliefs and judgments about products more quickly than those with less prior knowledge when quality cues are not unexpected(Heiman et al. 2001; Sujan, 1985).

Prior research has examined search efficiency as one of the predictors of consumer search levels (e.g., Brucks, 1985; Goldman, 1977; Goldman and Johansson, 1978; Ratchford and Srinivasan, 1993).

Search efficiency is defined as the degree to which a consumer is able to identify, assess and exploit the appropriate market sources for the optimal search strategy(Goldman and Johansson, 1978). Two important factors influencing search efficiency include a consumer's knowledge and/or experience about the market and exposure to relevant information during the search process(Goldman, 1977; Ratchford and Srinivasan, 1993). A greater degree of market knowledge and exposure to relevant information will enable the consumer to examine only the appropriate relevant sources of search(and ignore the irrelevant sources), thereby enhancing the efficiency of the search. Search efficiency also makes it easier for the consumer to acquire and process new information(Brucks, 1985).

Therefore, experts will need to expend less effort in learning new technologies, enabling them to adapt new ones more efficiently. As they need less effort to search for information and to assess alternatives, the costs of switching will decline (Kerin et al., 1992). Thus compared to novices, expert consumers find it much easier to search for information, evaluate it, and learn an alternative technology. With this regard, expert consumers will be less reluctant than novices to adopt an alternative technology. Therefore,

**Proposition 3**: Technology expertise will be negatively associated with the costs of switching from an incumbent technology.

### 2.4. Consequence of Switching Costs: Behavioral Intentions

Switching costs refer to costs expressed as the time, efforts and financial risk involved in switching from a particular type of technology. Pre-switching search and evaluation costs represent consumer perceptions of the time and effort involved in seeking out information about available alternatives and in evaluating their viability prior to switching(Zeithaml, 1981). Learning also occurs after switching, as consumers adjust to a new alternative. Consumer perceptions of the time and effort needed to acquire and adapt to these new procedures and routines are referred to as post-switching behavioral and cognitive costs. Cost-benefit models of behavior suggest that consumers engage in activities if the perceived benefits outweigh the perceived costs. All else being equal, the higher perceived costs of switching should reduce the likelihood that consumers will switch service providers(Anderson, 1994; Jones et al. 2002). Switching costs may be a significant impediment to the adoption of a new technology, acting as a barrier to new entrants by making consumers favor incumbent technologies (Porter, 1980).

High-technology markets are characterized by a high level of uncertainty. Rapidly changing technologies and the absence of relevant information are the main sources of this uncertainty(Heide and Weiss, 1995). This means that the costs and risks involved in switching from a technology will influence the choice behavior of consumers. Therefore, switching costs create dependence and inertia; new technology keeps getting more costly for new consumers, at least in terms of the time required to master it. Consumers' anticipation of high switching costs gives rise to their interests in maintaining a continuous relationship and commitment to incumbent technologies(Dwyer et al., 1987).

Consumers in high-technology markets tend to want their product usage skills, which they have developed on one technology/brand of a product class, to be transferable across all technologies /brands. Thus, consumers who develop nontransferable product-specific skills may be unwilling to learn how to use a new product(Alba and Hutchinson, 1987). The effect grows with time, and

consumers are forced to commit to incumbent technologies as the costs of switching continue to increase(Kotabe et al., 1996). Further, commitment has been conceptualized in terms of a temporal dimension, focusing on the fact that commitment becomes meaningful only when it develops consistency over time(Moorman et al., 1992). As a result of continuity, consumer turnover may be reduced and a relationship can be maintained (Ganesan, 1995).

**Proposition 4**: The costs of switching technologies will encourage commitment to the incumbent technology.

## III. Discussion

When consumers have built up large technology -specific switching costs, they tend to commit to incumbent technologies and put less effort into their searches and decision processes. The knowledge that the adoption of new technology is likely to involve nontrivial levels of switching costs creates a disincentive for consumers to search outside the established portfolio, and may result in constrained search processes(Jackson, 1985; Shapiro and Varian, 1999).

As switching costs act as an entry barrier against new entrants to the market(Porter, 1980), and these invisible barriers are voluntarily established by consumers, incumbent technologies can easily maintain(or increase) their market shares. As a consequence of their constrained searches, consumers with strong relationships with certain technologies may perceive less change to have taken place in the market than has actually occurred; this in turn lowers their incentives to engage in market searches. The presence of high switching costs therefore tends to buffer consumers from information about competing technologies and to show continuous commitment to incumbent technologies.

As such, ex-ante homogeneous products become ex-post heterogeneous. From the theoretical perspective, customer switching costs confer market power on firms. Thus, firms may face a trade -off between charging low prices to attract customers and locking them in, and high prices to extract high profit from its already locked-in customers.

As the economy becomes more interconnected, issues of compatibility become more important in industries such as computers, telecommunications and consumer electronics. The last decade has witnessed a shift from a focus on the value created by a single firm and product to an examination of the value created by networks of firms whose assets are commingled with those of external entities. Thus, managers seeking to expand the strategic reach of a company should quickly address the networks associated with the product. For example, the diffusion of high- definition television has largely depended on the complements network, allowing the television to not only broadcast programming as is commonly cited, but also other forms of digital input, such as those from DVD players(Heller, 2001). The creation of complementary resources(for instance, the greater availability of films in a VHS than in a Beta format) played a crucial role in boosting JVC's VHS system, which in the end almost completely displaced Sony's Betamax.

In addition, there are large gains to be made from compatible networks. Positive spillovers in the creation of know-how accelerate the race of progress when a community of users or producers coalesces around a common standard. Apple's emphasis on its proprietary hardware standards, in contrast to the *de facto* open standards built

around the IBM personal computer platform, made for a winner-take-all battle for the attention of third-party hardware and software developers. Specialist suppliers with state-of-the-art know-how are increasingly deserting Apple for the Wintel network. This, in turn, this weakens the Apple product itself, as the firm is falling further and further behind in keeping its subsystems up to date. Therefore, this suggests that the commitment decisions of consumers and their willingness to pay a premium price for a product will be related to the demand associated with the product.

Even though there may be no acceleration in the pace of improvement of any one relevant product dimension for any one system component, the confluence of multidimensional, product line-based, multicomponent changes can, at the level of the system, convey the sense of a faster pace. Thus the beat of Moore's law may remain for two years, but with one aspect of a product changing now, a second six months later, and different changes being implemented at different times in different models in a product line, and with different suppliers following not-always-coordinated timetables, the effective systemwide pace for the consumer may be less than two years. Given the competitive imperative to be first to market with a new and improved version of a product, the consumer may see the pace accelerate ever more quickly(Dhebar, 1996).

Technology changes(or upgrades) impose lower switching costs for consumers than a move to an entirely new technology. When considering a new product release that involves significant changes to the user interface, consumers must weigh the potential benefits of any new features against the time and effort involved in relearning the interface: therefore, they tend to remain with their existing choices(Besen and Farrell, 1994). It is possible to upgrade an existing technology in steps, by upgrading modules rather than overhauling the entire product. Switching to an upgraded module imposes lower switching costs on consumers than a wholesale shift in technology(Kotabe et al., 1996).

Perhaps the best way to sustain a rapid pace in the improvement of technology and not to have consumers defer purchase is to offer modular upgradability. This allows owners of existing versions to selectively upgrade the version they own, rather than disposing of it entirely to purchase a new and improved one. Modular upgrades can make consumers more flexible with respect to their investment in a durable product and they can be targeted at consumers who most value the upgrades. Modular upgrades are an especially attractive solution when there is a growing disparity in the products' various lives.

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