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# Sustainable competitive advantage of a system goods innovator in a market with network effects and entry threats

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ABSTRACT

An innovator (a firm) introducing a technology for system goods into a market with network effects can adopt various licensing strategies. The innovator's strategy spectrum could include being a monopolist for an entire system using a proprietary technology, for only a set of components, or for one of the firms in a competitive market by licensing (opening) all of its technology to others firms. Regarding the choice of these strategic options, two conflicting schools of thought have emerged: network effects theory and leverage theory. Although the former encourages the innovator to completely reveal or open its technology in order to benefit from increased compatibility, the latter recommends the innovator to strictly withhold and protect its proprietary technology in order to avoid future competition. A few historical examples, such as the PC platform competition of IBM and Apple, suggest that neither of these extreme measures lead to business success. Therefore, a model has been developed in order to integrate these two perspectives. Our results suggest that while network effects encourage firms to open technology to a limited extent, they should strictly protect their "core" technological competency in order to minimize future competition.



## 1. Introduction

Numerous high-tech products such as personal computers (PCs) possess especially complex structures because they are a combination of components built on platforms. When a product is functionally interdependent with a majority of the other components of a system, and the end-user demands the overall system, it may be termed a "platform" [17]. The platform's market structure is determined by an innovator's decision regarding the commercializing strategy. An innovator may possess proprietary control over the entire system in a vertically integrated production structure, or a monopoly over a limited proprietary part, or only be a brand-name platform producer, who integrates the components of the platform that are supplied by third parties. This presents the intrinsic coordination question regarding the commercialization of a platform [28]. Two historical examples from the PC industry present rather different viewpoints regarding this problem.

Apple Computers has been producing highly integrated PCs and controlling the proprietary rights over its products since the 1970s. Generally, the performance of highly integrated platform products is expected to be superior. However, Apple decided not to establish a large PC network and therefore did not establish interconnections with others. Instead, it has been focusing on the development of mania groups using fancy products. However, this niche strategy is inherently dangerous in markets with strong network effects [34]. In contrast, by employing an open architecture strategy, IBM offers a variety of IBM compatible PCs, thereby fulfilling the demand of numerous customers. Since a majority of the personal computers sold were IBM-compatible, IBM was recognized as a platform owner in the market, and others identified their brands as IBM-compatible. Apple Computers, who was the market leader in the 1970s, lost their market share to IBM-compatibles; therefore, IBM became the platform owner in the PC industry in the early 1980s. The competition between these two extreme marketing strategies indicates that the network effect is a critical factor that must be considered when a firm determines a commercialization strategy for its platform product. Clones were deliberately invited into the incumbent market in order to maximize the benefit of the network effects [10]. The case of IBM emphasizes that until the incumbent continues to produce products of a quality that is superior than those produced by its clones, the incumbent may be at an advantage when it acts as a monopolist by protecting its technology. This is because the increased user-base enables incumbents to enhance their profits by charging high-value consumers a high price.

However, once IBM's open architecture began permitting numerous manufacturers of IBM-compatible computers to produce PCs whose quality was at par with those of IBM's, clones could no longer be exploited by them to increase their profits and in fact became market impediments that reduced IBM's profits, which resulted in the

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creation of an almost perfectly competitive market. Compaq, the leader among IBM clones aggressively threatened IBM's position. IBM's market share declined from 30.7% in 1985 to 16.9% in 1989 [26]. This indicates that IBM's open-standard strategy failed to deliver long-term success.

In this context, the existence of seemingly conflicting opinions regarding the open-standard strategy resulted in the emergence of the leverage theory. The leverage theory [5,9,32] encourages platform owners to completely withhold proprietary technology in order to avoid future competition with entrants. An open architecture and a cloning strategy facilitate the reverse-engineering of proprietary components, which enables new firms to enter the market. If a new competitor succeeds in entering the market using reverse-engineering, the negative impact of rent dissipation may exceed the benefit derived from the network effects. Therefore, it is recommended that all components are included in a vertically integrated market structure in order to restrict the entry of new firms. This strategy is consistent with that of Apple Computers; however, this strategy also failed [34]. Unlike IBM, Apple Computers retained all the technological expertise for its Apple series computers in-house, and therefore produced incompatible PCs. Apple failed to establish a formidable standard in the PC market and held only 20% of the market by 1983 [26].

The strategic failures of platform owners in the PC market indicate the limitations of these two contrary perspectives. Now, we will identify those aspects of network effects that were overlooked by Conner [10] in the creation of an effective cloning strategy of a network platform. Moreover, the reasons for the recent revision of the term "IBM-compatible" to "Wintel-compatible" will be investigated. Currently, Intel and Microsoft (MS) are essentially considered to be the platform owners in the PC market. The term "Platform owner" represents a firm that possesses the ability to control the evolution of the platform architecture, and the likelihood of innovation in complementary markets. Hence platform owner leads the commercialization of a system platform and receives the maximum benefit from a successful commercialization [17]. By 1986, IBM realized that it had established a standard and in doing so, they had spawned a number of imitators by ceding the rights to their most valuable PC components to Intel and MS [26]. When IBM adopted the cloning strategy, it could not ensure that the quality of its products would be superior than that of its "clones" unless it maintained a veiled technology. However, IBM possessed no such proprietary core technology that would enable it to deliver a higher quality than its clones. Moreover, the term "clone" implies that their product quality is comparable to that of the incumbent; therefore, it is unlikely that users perceive IBM's products to be of a higher quality than that of its "clones."

These historical examples prompted us to investigate the characteristics that a platform owner must possess in order to be successful. An analytical model was developed in order to answer the following research question: In a high-tech market, which is characterized by strong network effects and entry threats, what enables a company to become a sustainable platform owner? In a high-tech market, technological innovation and consumer acceptance advance rapidly, which makes it rather difficult for the incumbent to acquire a durable first-mover advantage [31]. Our results indicate the strategic importance of proprietary technology management and its synergistic resolution with the network effects environment.

## 2. Theoretical background

In this section, we review the studies regarding the leverage theory and the network effects. These are the two representative theories regarding product commercialization that offer various insights on platform strategy. The development of these two strategic schools of thought is closely related to the production structure in the market. Therefore, we investigate the meaning of each theory from this perspective. Moreover, in order to understand our research question more comprehensively, we further investigate the history and characteristics of the PC industry in detail.

### 2.1. Leverage theory

The leverage theory focuses on leveraging the monopoly power of the incumbent for protecting its position. In this section, we examine the manner in which this theory is related to the platform strategy of an innovator. Leverage theory encourages vertical foreclosure of entries by tying components [5,32]. Basically, tying refers to a strategy wherein a seller ties and sells two or more goods together. However, for an incumbent, this strategy is more significant than the concept of bundled sales [4,33]. The incumbent may employ tying in order to protect its monopolistic position, i.e., to create an entry barrier [5,9,32].

Previous studies indicate the impact of foreclosure of entry essentially from two perspectives. First, tying reduces incentives of entrants' investment [8,9]. For example, a monopolistic incumbent of a PC platform may face competition from potential entrants for all its components. However, when an incumbent adopts a tie-in sales strategy for an entire platform, a potential entrant may enter the market only if it succeeds in innovating all the components of the platform. Alternatively, in order to complete the platform, an entrant must depend on another entrants' provision of complementary components. If an entrant only partially succeeds in innovating its components and no other player produces the complementary parts, then the entrant cannot enter the market when the incumbent employs a tie-in sales strategy. Therefore, a comparison between tying and untying may reduce the research and development (R&D) investment incentives of entrants, thereby strengthening the incumbent's monopoly position [5,9]. In particular, this concept is rather relevant in a high-tech industry where the innovation of each component requires substantial investments; however, the success of R&D is characterized by a significant amount of uncertainty [9].

Second, if the incumbent adopts tying, it can protect its monopolistic position more easily by employing a price-cost squeeze [2,12]. For example, assume that there exists a monopolistic incumbent with a tied platform, which comprises only two components, A and B. If there are two independent entrants for components A and B, then the incumbent may establish the prices of the components in such a manner that the price of one component is lower than that of the entrant's in order to put competitive pressure on the independent entrants. Although the price that the incumbent establishes for component B is lower than that of marginal cost, the incumbent may recover this loss by charging a high price for component A in the presence of tying. Although such tactics require the incumbent to charge prices that do not maximize the current profits of the two components, the incumbent can compensate the lower short-term profits with higher potential future profits once it has discouraged the new firms from entering the market [2]. Owing to the practice of such a prohibitive and predatory pricing, the entrant who considers component B as a complementary product cannot enter the market because it has no other components for recovering the loss accrued on account the predatory pricing of B. Consequently, the entrant for component B will not be able to enter the market. As a result, the entrant of component A will also not be able to enter the market owing to a lack of complementary components [12].

Therefore, from these two perspectives – reduction of the entrant's R&D incentives and price-cost squeeze – tying enables incumbents to maintain their monopolistic position. The logic behind Apple's tying strategy for its Apple series computers may be understood by focusing on the leveraging effect of tying. However, Apple's closed architecture and tying strategy was unsuccessful for their PC products wherein a number of strongly complementary components had been collectively employed. In the 1980s, IBM declared an "open-standard," following which several IBM clones entered the PC market with PCs that were rather similar to and compatible with the IBM PCs. However, Apple