Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2004 Proceedings

Americas Conference on Information Systems (AMCIS)

December 2004

A Model for Examining Standards Competition in Two-Sided Markets Subject to Network Externalities:The Case of the Console Video Game Industry

John Gallaugher
Boston College

A Model for Examining Standards Competition in Two-Sided Markets Subject to Network Externalities: The Case of the Console Video Game Industry

John Gallaugher
Wallace E. Carroll School of Management, Boston College
john.gallaugher@bc.edu

ABSTRACT

The enclosed paper proposes a model for examining competing, non-compatible standards in two-sided markets subject to network effects. The context proposed for examination is the market for video game consoles and their complementary products (i.e. game titles). A set of hypotheses are developed related to this context. This work ties together related literatures in information systems, strategy, and economics and is offered as a precursor to forthcoming empirical analysis using the developed model and hypotheses.

Keywords

Entertainment, Video Game Market, Network Effects, Network Externalities, Two-sided Markets, Standards, Mindshare, Model Development.

INTRODUCTION

Technology standards are at the heart of competition in several multi-billion dollar industries, most notably in high-tech and consumer electronics markets. The battle for leadership in operating systems, application software, microprocessors, and all manner of telecommunications and computer hardware markets are impacted by the control or accessibility of dominant standards.

A product standard determines a product's interoperability. This suggests that the attractiveness of one product standard over another is highly related to network externalities – that is, some products or services become more valuable as that product's installed base expands (Farrell and Saloner, 1985; Katz and Shapiro 1985). This value is derived primarily from three factors (Gallaugher and Wang, 2002): exchange (owners of goods supporting dominant standards can interact with a greater number of peers, exchanging data, money, programs, etc.), stability (many technology products require investments in learning, software, and file creation that greatly exceed the initial purchase cost, and which creates a resistance to experimenting with unproven standards that may fail and require a switch), and complementary goods (such as third-party software supporting the platform, add-on products, labor, or other resources provided by a firm other than the standards owner, but that further enhance the appeal of a product).

Markets subject to network effects are different from traditional markets. Competition occurs early and is particularly fierce. This because markets are susceptible to bandwagons, with prospective adopters favoring firms that appear to be establishing a sustainable lead. Critically important – these markets exhibit monopolistic tendencies. The natural state in many standards-based markets is for there to be one clearly dominant player. Perhaps most interestingly, it has been hypothesized that if network effects are strong, the best products don't necessarily win, that is products widely regarded as superior from a technical or quality perspective may still have limited appeal if they do not have a large enough user base.

Billion dollar firms are betting their future on radically different approaches to the standards battle. For example, Dell has embraced Microsoft and Intel standards, while Sun and Apple have opted largely to craft their own variants. Sony has regularly pioneered proprietary standards in technologies for video, audio, and static memory devices, with varying degrees of success. These disparate approaches reflect the relative lack of understanding among both practitioners and researchers regarding the underlying strategic, economic, and technology issues associated with competition among proprietary standards. Simply put, these issues are the lifeblood of competition in technology markets, therefore research in this area is likely to be well received by both the practitioner and research communities.

RESEARCH QUESTIONS

This research project focuses on market competition among rival firms that control separate, proprietary standards. Key questions pursued in this work include:

- What, if any, is the impact of a firm's market entry timing on its competitive position?
- How does a firm jump-start network effects of a new standard?
- Should a firm craft its own complementary products (e.g. should a hardware company make its own software), or should it rely on third-party markets to do so?
- Should firms seek exclusive agreements with providers of complementary goods?
- To what extent does compatibility with a prior standard influence the success of a new platform?

While research on standards and network effects in IT markets is gaining increasing exposure in top-tier publications (Brynjolfsson and Kemerer, 1997; Gallaugher and Wang, 2002; Schilling, 2002), there is a need in the literature to synthesize theory and present a detailed model of the breadth of issues outlined above in this critically important intersection of strategy, economics, and technology. Such a model could then be leveraged to address the scant amount of empirical work examining the related support and reference theories in these areas.

CONTEXT

The context for the initial study is the multi-billion dollar video game market. One of the few bright spots in the otherwise bleak technology industry over the past few years, the video game market is now larger than the US domestic box-office gross for motion pictures. To understand the industry's importance consider the following:

- Sony earns the majority of its operating income from the Sony PlayStation franchise – it is more important to the world's #1 brand than its motion picture studios, recording labels, or consumer electronics segments (Rose, 2003).
- In 2001, the largest R&D budget at Microsoft, the world's largest software firm, has been for the firm's XBox division – a figure larger than R&D spent on the firm's core operating systems, application, and growing server and mobile software businesses (Acohido, 2002).
- Video games have become significant marketing vehicles for firms. For example, Porsche chose to introduce its Cayenne SUV via 'virtual' introduction in the $1.7 billion dollar submarket for racing game market, and Mitsubishi, Subaru, and other auto firms actively work with game designers (Naughton, 2003).

The video game industry contains all of the characteristics necessary to explore the key competitive dynamics above. There are issues that determine the technical specifications of the product, there are competing hardware platforms that have been introduced at different time intervals. And there are both established and new entrants into the field. The market will also allow for the tracking of titles made available from major console providers (Sony, Microsoft, and Nintendo), vs. those provided by the broader market.

THEORETICAL MODEL, CONCEPTUAL MODEL, AND HYPOTHESES DEVELOPMENT

The study of network goods (that is, products or services subject to network externalities) is based in a deceptively simple theoretical model (Farrell and Saloner, 1986; Saloner and Shepard, 1993; Kauffman et al, 2000).

$V = a + b(N)$

In this model, the value (V) that consumers derive from a network product is a function of "stand-alone" benefit and network externalities. The term a denotes the "stand-alone" benefit that a consumer derives from the product features. The term $b(N)$ represents the feature-independent value derived from a network of size N. Because user value increases with network size, $b(N)$ is an increasing function of the installed base, N.

The creation of an empirical model studying network markets requires the decomposition of the above theoretical model into measurable and testable components. The following model is proposed and is described below.

$C = f(T, S, VI, F, T)$

For the context studied, the theoretical model variable (V), representing consumer value will be measured via the market share of a video game console (C). This alignment is theory-consistent, given that network effects are defied as products or services where consumer value increases as installed base expands (Farrell and Saloner, 1985; Katz and Shapiro 1985).

The market for video game consoles is seen as a two-sided market (Rochet and Tirole, 2001; Gallaugher and Wang, 2002). In such markets, two products (in this case the game console and software which runs on the console) generate share-based benefits that influence the value of the observed product (the console). As such, console share (*C*) should be positively associated with the number of titles (*T*) available on the platform.

HYPOTHESIS 1: Products with more software titles available for their platform will enjoy larger console market share.

Theory suggests that if users place value on compatibility, such compatibility should be a source of network externalities (Katz and Shapiro, 1992). Compatibility may be particularly significant if it implies complementary products available via a prior product version can run on a new platform. One should note that software influencing demand for a console can include titles that are designed for the current standard, as well as those designed for a prior standard. In the video game business, prior standards are largely closed to competition (Schilling, 2003), e.g. Nintendo's games won't run on Sony platforms and vice versa. It is therefore assumed that products compatible with prior technology standards (*S*) will be more desired by consumers due to the fact that such platforms deliver increased title choice (enhancing network effects).

HYPOTHESIS 2: Products compatible with prior standards will enjoy larger console market share.

Firms which provide their own product complement may be considered as vertically integrating (Economides, 1996). However, it is noted that such vertical integration does not have to be exclusive - in the case of the video game industry, software titles are provided by both console providers as well as third-parties. Given that the establishment of an early network effect is based on titles provided, it follows that firms which provide their own titles to the market may enjoy an advantage over rivals that do not.

HYPOTHESIS 3: Firms which vertically integrate and provide the market with their own titles will enjoy larger market share for their console products.

Consumers clearly pay attention to product features. However, one of the unique characteristics of network goods is that the 'best' or highest quality product may not always be the most highly valued by consumers (Rochet and Tirole, 2001). This would occur if network effects were particularly strong in the market, if one player had managed to secure substantive network benefits, and if technologies used by major players are relatively similar. Schilling (2003) refers to the situation where there are significant gaps among competing product generations as 'technical leapfrogging'. It is assumed, however, in the hyper-competitive market for video game console systems that most major players offer sufficiently comparable products such that technical leapfrogging hasn't occurred, and that features (*F*) will not show up as significantly influencing console market share.

HYPOTHESIS 4: Product features will not be a significant factor in influencing a console product's market share vs. its current generation product rivals.

Consumers considering the adoption of a particular network good are concerned about the product's current and future installed base (Arthur, 1989). As such, consumers are called upon to make predictions regarding the future viability of a product offering. Future viability can be particularly important to adopters of hardware/software platforms, since consumers often invest in software and other resources that extend the investment significantly beyond the initial hardware purchase price. Factors such as product awareness or mindshare can thus influence an adoptor's decision calculus (Arthur, 1989; Gallaugher and Wang, 2002; Schilling, 2003). It is assumed that products that have been on the market for a longer period of time (*T*) have had an opportunity to gain consumer mindshare and will reap associated market share benefits.

HYPOTHESIS 5: Console products that have been on the market longer will enjoy mind share advantages over rivals, which in-turn positively influence console market share.

CONTRIBUTION

The model extends earlier work in several important ways. *First*, it accounts for the situation presented by two-sided markets, an area where there has been scant prior theoretical as well as empirical work, particularly in consumer product markets. *Second*, the issue of vertical integration is examined to see if firms providing a greater number of their own titles enjoy any share advantages for their hardware platform. *Third*, the study examines whether or not compatability with a prior generation is influential in choosing current generation hardware products. *Fourth*, the model considers consumer awareness (mindshare). *Fifth*, the impact of technical standards is examined. Should technical standards be insignificant, this would suggest both that network effects are strong in this market and that technology leapfrogging hasn't occurred. *Sixth*, the issue of market timing is examined.

Taken together these findings may suggest substantive strategies for developers of new composite products subject to two-sided network effects. These would include, among others, favoring product introduction over including additional features, investing in product promotion to encourage mindshare, and diverting resources or raising additional capital to support an in-house development effort for complementary products. Given the disparate competitive landscape in video game consoles, the wide variety of competitive approaches to this industry, and the similarities between this industry and other two-sided markets (Rochet and Tirole, 2001; Gallaugher and Wang, 2002), understanding the dynamics of competition in this market and the factors critical to market success should yield important insights for a number of current and future industries.

FURTHER WORK

Development of an appropriate theoretical and conceptual model is the first phase in this project. A number of the support literatures referred to in this study are theoretical in nature. Therefore, a direct goal of this research is to provide an empirical investigation of the underlying theoretical issues that drive the above research questions but that have thus far lacked significant empirical support. Given the need for further empirical research in this area, it is believed that the results of this work will have wide appeal. It should be noted that the bulk of data required for testing the proposed model has already been collected. Comments regarding the conceptualization outlined above are most welcome, as these will shape future analysis. It is hoped that preliminary empirical results will be shared at the upcoming conference.

REFERENCES

1. Acohido, B. "Will Microsoft's Xbox Hit the Spot?" *USA Today*, June, 4, 2002, p. B1.
2. Arthur, W. B., "Competing Technologies, Increasing Returns, and Lock-In by Historical Events," *The Economic Journal*, Vol. 99, No. 394, March 1989, pp. 116-131.
3. Brynjolfsson, E. and Kemerer, C.F. "Network Externalities in Microcomputer Software: An Econometric Analysis of the Spreadsheet Market," *Management Science*, Vol. 42, No. 12, 1996, pp. 1627-1647.
4. Economides, N. "The Economics of Networks," *International Journal of Industrial Organization*, Vol. 14 No. 6, 1996, pp. 673-700.
5. Farrell, J. and Saloner, G. "Standardization, Compatibility, and Innovation," *Rand Journal of Economics*, Vol. 16, No. 1, 1985, pp. 70-83.
6. Gallaugher, J.M, and Wang, Y. " Understanding Network Effects in Software Markets: Evidence from Web Server Pricing ," *MIS Quarterly*, Vol. 22, No. 4, December 2002, pp. 303-327.
7. Katz, M.L. and Shapiro, C. "Network Externalities, Competition, and Compatibility," *American Economic Review*, Vol. 75, No. 3, 1985, pp. 424-440.
8. Katz, M.L. and Shapiro, C. "Product Introduction with Network Externalities," *Journal of Industrial Economics*, Vol. 40, No. 1, 1992, pp. 55-83.
9. Naughton, K. "Pixels to Pavement," *Newsweek*, Vol. 141 Issue 10, March 10, 2003, pp. 46-49.
10. Rose, F. "The Civil War Inside Sony," *Wired*, Vol. 11, No. 2, February 2003 (http://www.wired.com/wired/archive/11.02/sony.html).
11. Rochet, J. and Tirole, J. "Platform Competition in Two-Sided Markets," *Proceedings of the Joint Workshop on Industrial Organization*, Toulouse, France, 2001.
12. Schilling, M.A. "Technology Success and Failure in Winner-Take-All Markets: The Impact of Learning Orientation, Timing, and Network Externalities," *Academy of Management Journal*, Vol. 45, No. 2, 2002, pp. 387-398.
13. Schilling, M.A. "Technological Leapfrogging: Lessons from the U.S. Video Game Console Industry," *California Management Review*, Vol. 45, No. 3, Spring 2003, pp. 6-32.