

MONOPOLY POWER IN STANDARDS IS A MYTH

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ABSTRACT

This paper explores the optimal organization of an industry of manufacturers who require standards to make their products function. We apply concepts found in neo-classical economics and concepts from increasing returns in order to show that IT standards, in particular, are natural monopolies. We further illustrate that once the manufacturers of IT intensive products realize that a monopolistically supplied standard will be more costly than a competitive standard, they will organize to mitigate the monopolistic supply problem. Specifically, we propose that they engage in a strategy of *coopetition*, wherein manufacturers that compete in the final goods market, cooperate in developing standards as a provision of inputs. This means that, as an industry, manufacturers can gain the advantages of a single supplier, while mitigating the costs of monopolistic supply, by jointly owning the standard authority. We illustrate this idea with the market dynamics of the DVD standard.

Keywords: Standards, network effects, network externalities, increasing returns, coopetition, industrial organizations.

INTRODUCTION

The importance of standards for information systems (IS) is undeniable. In his letter to Business week, Michael Dell admits that there is a “shift in customers’ preference to standard based technology and away from expensive proprietary systems” (Dell 2003, p.18). Standards not only help reduce uncertainty in the minds of customers but also help industry move forward. Bill Gates notes that businesses can put together software pieces more rapidly and flawlessly now than before (Orenstein 2000). One of the central functional roles of a chief information officer in an organization is to set standards and manage interoperability (Libicki 1995). It’s because of standardization, that customers across the country can connect to the internet through their wireless devices in any Starbucks coffee outlet (Maier 2002).

Information technology (IT) standards are no longer solely an engineering issue. Control of IT standards can be very lucrative and guarantee businesses super normal profits for extended periods (David et al. 1990; Shapiro et al. 1999b). They have become a strategic tool in the hands of businesses to gain competitive advantage and control the market. Incompatibility exists not because of lack of technical expertise but because of the self-seeking nature of businesses (Shirky 2000). There is often an implacable standards war before a dominant standard emerges (Shapiro et al. 1999a). It does not make good business sense to be part of these battles. Not only are there far more losers than winners, but the uncertainty that multiple standards bring to the marketplace retards adoption of all standards, so there may be no winners at all.

Prior strategy literature on standards has focused mainly on how the owner of a standard can maximize its value from the control of a standard (Dranove et al.; Shapiro et al. 1999b). In doing so, the literature has largely ignored the viewpoint of the customer of those standards—the manufacturers of products. End consumers do not usually buy standards, but rather purchase a product in which the standards are embedded. It is the manufacturer of those products that pay the licensing fees for the standards. Thus, the customers of standard owner are usually large, powerful commercial entities who have the clout, the resources, and the knowledge to shape industries. This means that traditional analysis of standards with passive customers is problematic, and new forms of industrial organization are needed to address the problems inherent in standards.

We posit that, because IT standards are generally associated with network externalities and economies of scale, they are natural monopolies. A single standard generates greater network effects and cost less than multiple standards. However, having a standard controlled by a single firm leads to monopolistic pricing. We put forward that IT industries can obtain the benefits of network externalities and scale while ameliorating the negative consequences of monopolistic supply by reorganizing the provision of standards as cooperation¹ (Bradenburger et al. 1996; Dagnino et al.; Garraffo).

THEORY DEVELOPMENT

We would like to briefly outline the theory and then define the terms before proceeding with the detailed analysis.

IT standards are natural monopolies. In general, an industry will only support one standard in the long run. The primary reason for this is, that as a means of communication, standards are possessed of network externalities (Economides 1996; Gallagher et al. 2002; Kauffman et al. 2000). In addition, developing IT standards requires a huge upfront cost. It is preferable for an industry to only pay this cost once.

With monopolistically supplied IT standards, the customer's welfare is dependant on the monopolist's pricing strategies. A single entity with control over dominant standards can behave opportunistically and charge monopolistic premiums to users. Thus, all benefits of falling average costs and network externalities accrue to the supplier of standards and customers may end up paying monopolistic premiums for the use of the standard.

The above represents two conflicting scenarios for organizations wanting to adopt standards. Scale benefits tend to arise naturally for standards, which suggest that standards should be provided for externally, benefiting from vendors economies of scale. However, adopting IT standards from external supplier puts manufacturer at risk of being charged monopolistic premium, which would suggest that IT standards should be provided for internally.

Defining roles

Before proceeding with theory development, it is useful to define some terms and concepts. First, we assert that standards do not possess intrinsic worth, but rather generate value only when embedded in some usable product that is then sold to end consumers. This implies three distinct entities in the value chain—the standard authority, the manufacturer of the product, and

¹ We define cooperation in detail later in the paper. However, for the reader's convenience cooperation is cooperation among competitors.

the end consumer—as illustrated in Figure 1. We are concerned with the economic, legal and strategic relationship between the manufacturers and the standard authority, and thus do not further discuss the end consumer.

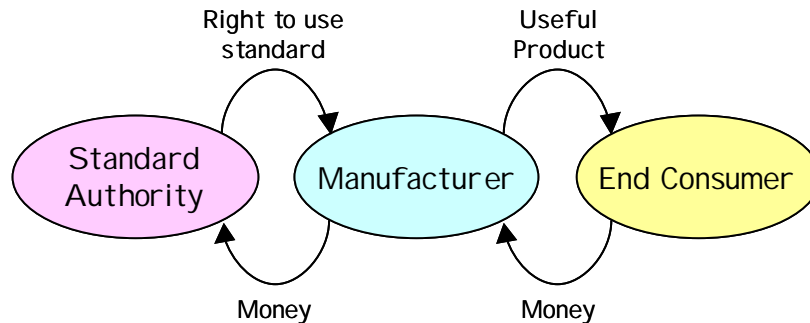


Figure 1: Conceptualization of Market

The standard authority is the organization that controls and administers the standard. The defining characteristic of the standard authority is the ability to decide which other entities may use the standard. This is generally decided based on a cash transfer. The manufacturer is the organization that creates the useful product for the end consumer. Throughout this paper, manufacturer refers to an organization that uses a standard to create a product, and a standard authority refers to an organization that controls a standard. We also note that the manufacture of an end product and the control of a standard may not always be independent functions. However, for conceptual clarity, this paper assumes independence of these two activities, so that there are no particular gains (or losses) from combining or separating the two activities.

We define IT standards as a set of technical specifications that allow communication between IT entities. We conceptualize standards into 2 broad categories—product standards and process standards. Product standards are a set of technical specifications that define how IT products interact with each other (e.g. TCP/IP, Wireless 802.11b and 802.11g). Process standards are a set of technical specifications that define how people developing systems interact with each other (e.g. RUP, extreme programming and systems development life cycle).

We limit the scope of our paper to discussing IT product standards only. We do this to maintain conceptual clarity and ease of understanding. Monopolistic problems usually arise more often in IT product standards than IT process standards. IT product standards are more thoroughly codified and hence can be legally protected. Whereas, IT process standards are more flexible and less codified. IT product standards are frequently developed by a single entity with the express purpose of allowing communication between different products. IT process standards usually emerge from the best practices of groups across different organizations. IT product standards are generally software and, hence, can be replicated at virtually no cost. However, replicating IT process standards involves user training and expensive coaching, and thus, marginal costs can be substantial. We will discuss the implications of privately owned IT process standards in our discussion section.

We also assume no difference in the quality of competing standards. Again, we do this to maintain conceptual clarity and ease of understanding. This assumption can be relaxed without losing generalizability of our analysis. Markets are as likely to lock in to inferior standard as they are to lock into one which is superior (David 1985).

While prior work has focused on how a standard authority could maximize their welfare, we focus on how manufacturers (users of standards) should go about maximizing their own welfare. Prior work recognizes that manufacturers are significant decision makers and that their cooperation is necessary for a standard authority to achieve success (Cargill 1989; Jacobs 2000; Shapiro et al. 1998). However, the manufacturers were treated as relatively passive organizations whose only real choice was to decide which standard to use. Although this is a helpful abstraction, it misses a significant part of the story, particularly when the manufacturers are themselves organizations such as General Electric, IBM, and Sony, which possess both power and intelligence.

We take the opposite perspective in this work, focusing on the manufacturers' motivations, and treating the standard authority as a relatively passive organization. Again, it is a useful abstraction that allows us to concentrate solely on one aspect of the problem. Nevertheless, it is an abstraction, and thus does not relay the entire story. We do, however, hope that this gives the reader a new viewpoint on standards issues and encourages future research that considers both perspectives.

From the manufacturer's point of view, IT standards can be viewed as inputs into the production of IT intensive products. As is illustrated in Figure 2, standards form one of many inputs to a production process. For example, an end consumer may buy music as a final product. However, for a manufacturer to prerecord music, it requires the intellectual property of the song, the materials for the recording medium, and a variety of other inputs including encoding standards that allow the recording medium to be read by a player.

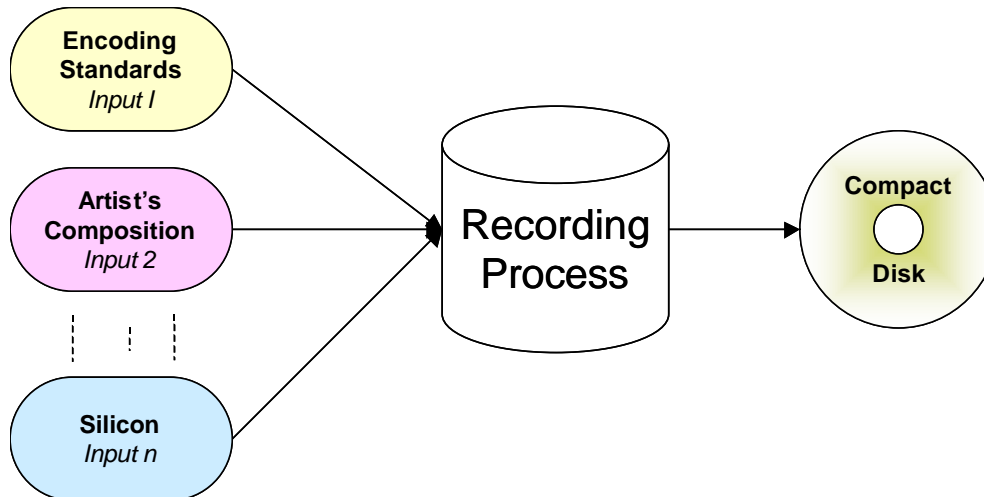


Figure 2: **Standards as one of the inputs of organizational process**

A manufacturer in need of IT standards can develop them internally or provide for them externally by adopting a third party standard. The main issue faced by the manufacturer, with respect to IT standards, is to minimize the total cost of those standards. That may be done by developing proprietary standards or adopting the standards of an external standards authority that has reached economies of scale.

The manufacturer is assumed to have no goal to profit from the sale of standards. This is where we depart from traditional economic thought about standards. We recognize that in reality, there is probably interest in the sale of standards, but that particular issue is well studied

(Dranove et al.; Shapiro et al. 1999b). This work is specifically interested in the examination of other goals, besides the sale of standards. Thus, we remove this goal to more clearly examine the impact of other goals. We repeat, again, that this does not tell the whole story, but it does offer a useful viewpoint that can be combined with the existent literature in order to more fully understand standards and their impact on industrial organization.

Standards as Natural Monopolies

IT standards are natural monopolies. Monopoly refers to a market structure where there is only one provider of a product—an IT standard in this case. The term natural means that industry-wide welfare can only be exploited with a single provider. This does not mean that industry-wide welfare will be maximized, but that the potential benefits are greatest with a single supplier. For IT standards, this naturalness arises from both demand side and supply side effects. On the supply side, avoiding paying high up-front costs multiple time, and the corresponding drop in average costs as a larger portion of the industry uses a single standard, results in a market that tends toward monopoly. On the demand side, network externalities, which arise from communication benefits of IT standards, and the up-front cost of deploying an IT standard, drive the market toward monopoly. We now examine each of these effects.

Falling Average cost

IT standards, being a knowledge product, require huge upfront investment and resource commitment from the organization (Arthur 1996; David et al. 1990; Shapiro et al. 1998). They require a great deal of intellectual effort by highly skilled and compensated teams and, thus, result in considerable upfront cost. Thereafter, the cost to replicate or distribute these standards is almost negligible. As production volume increases, the large up-front costs are amortized across a larger number of products, while marginal costs stay consistently low. Thus, average production costs tend to fall, as output increases.

However, these investments also represent sunk costs for the firm and the market as a whole. Since these are costs and they are substantial, multiple instances of their occurrence represent a sub optimal solution of allocation of economic resources. For example, Circuit City took a \$ 200 million write off for the development and marketing of DIVX and earmarked another \$114 million for exit costs (Newswire 1999). Thus, converging on one standard is a 'natural justice', and investing in only one standard is socio-economic rationality.

Network Externalities

Network effects arise when the value of membership in a network is an increasing function of the number of members on the network (Economides 1996; Kauffman et al. 2000). The causal process basically posits that, as more people adopt a particular standard, the value of that standard increases, encouraging additional adoption. This starts the process for demand side economies of scale. The virtuous circle continues, causing rapid growth in adoption and leading to economies wherein a single organization promptly emerges as the dominant player (Mantena et al. 1999). From a returns perspective, this means that there is tremendous opportunity cost for not adopting a dominant standard. As the adoption of dominant standard increases, the opportunity cost of alternative standard decreases because the network size increases, conversely the opportunity cost of not adopting the dominant standard increases. For example, while the production cost of a telephone is relatively small, the opportunity cost of not having equipment compatible with other phones would be enormous.

This provides an incentive for the new users to adopt the same standard as others. It is intuitive that more products developed on common standards will hold more value in the eyes of users than those developed in isolation. Products developed on common standards will be

compatible, resulting in greater user satisfaction. The initial gains and positive feedback soon translate into standards becoming the industry norm. The competition in the market continues to decline, gradually leaving a lone player in the market. With increasing returns, it is possible for just one standard to serve the needs of the entire market, thus forming a natural monopoly. As the competition dies out in the market, so does the capability of the adopters to negotiate better prices for licensing or using standards. In the long run, it is highly unlikely that more than one standard will survive, which means that the only remaining player in the market will have the capability of charging huge royalties.

Lock ins and SWITCHING costs

IT Standards are technology intensive products, and adoption involves a great amount of learning effort on the part of the adopter. Repeated use of standards makes the adopter comfortable and expert in the use of specific applications of standards. Moreover, a manufacturer will spend considerable time and effort in tooling-up its manufacturing line to assemble products based on a certain standard. This tooling-up includes not only actually configuring machines, but also putting into place the organizational structures, like help lines, marketing and branding, to optimize production based on a specific standard. As a consequence, it becomes hard for organizations to switch to a different standard in the short run. Like the large up-front costs in development, it is undesirable for manufacturers to pay learning costs repetitively.

In summary, IT product standards are natural monopolies. The intellectual contribution to their design requires huge up-front costs that an industry should only pay once. Similarly, the tooling-up costs for manufacturers is substantial. It is preferable for manufacturers to only have to pay these costs once. Lastly, IT standards are communication technologies, and as such, are characterized by network externalities. With a single supplier of the IT standard, all relevant products can talk to each other, which increase the value for everyone.

Monopolistically supplied Standards

The characteristics of IT standards discussed above suggest that a single standard is desirable in an industry. However, from the perspective of the manufacturer that must pay the licensing fee for a single IT standard, there is one significant problem. If the single industry standard is owned or controlled by a single organization, then that organization has great incentive to charge a premium for the use of the standard. Whichever organization eventually wins a standards war tends to then hold-up all of the other organizations in an industry, by charging them much more than they otherwise would.

For the purpose of this paper, we differentiate between monopolistically supplied IT standards and monopoly. Whereas, monopoly refers to a single standard authority, monopolistically supplied means, the standard authority exercises its monopoly control on the standard to charge a greater licensing fee than what it would have charged otherwise. The term, monopolistically supplied, captures the specific behavior of an organization where it acts opportunistically and takes advantage of its position in the industry.

The premium that must be paid for a monopolistically supplied standard depends on the number of competing standards. We assume one to one mapping between the number of suppliers and the number of standards. The problem is greatest with one supplier-one standard, but exists, to a smaller degree, for a small number of suppliers as well. Below, in Figure 3, we illustrate the price premium using a simple model of Cournot oligopoly. As the figure shows, the standard assumptions of competition hold until the number of suppliers of standards becomes very small, at which point the price premium increases dramatically. Standards exhibit high levels of

increasing returns and thus tend to have few suppliers. Hence, the monopolistic supply problem must be seriously considered.

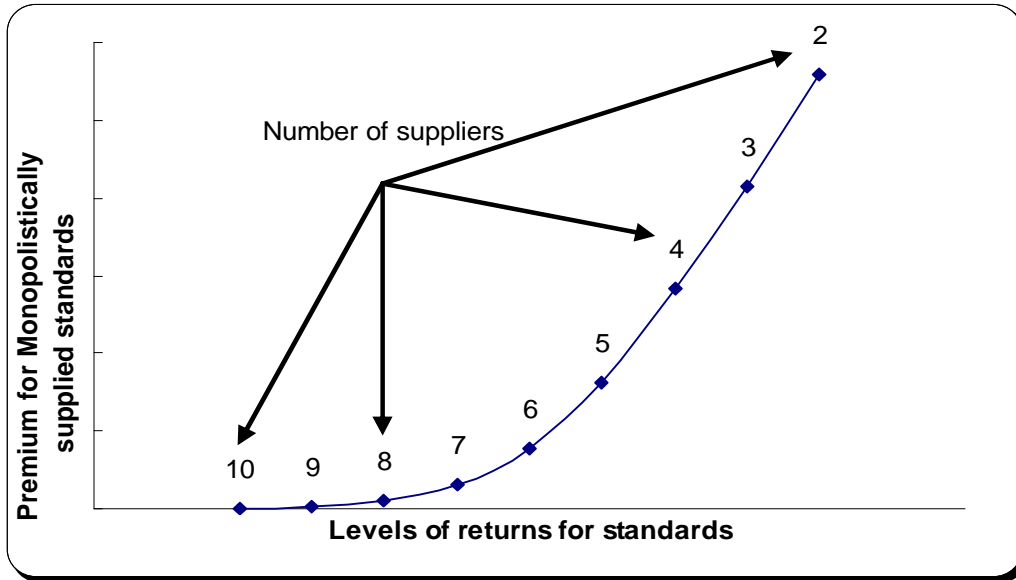


Figure 3: Price premium due to monopolistic supply of standards

About coopetition

While a single standard supplier benefits the industry (and the owner of the single standard), manufacturers are concerned with their individual benefits, which will be reduced by a monopolistically supplied standard. Manufacturers are largely stuck with the accidents of the past, but have learned from those accidents. For example, many buyers of Netscape server software purchased the software purely based on the fact that it was not controlled by Microsoft (Cusumano et al. 1998).

New technologies are being developed on an almost daily basis and thus new IT standards are needed on a similar basis. Manufacturers want to avoid a monopolistically supplied standard, yet want to gain the cost and network benefits of having a single agreed upon IT standard for a new product. To satisfy these opposing goals, manufacturers have developed an alternative strategy for the provision of IT standards, called coopetition.

Coopetition is the simultaneous cooperation and competition between organizations (Bradenburger et al. 1996; Dagnino et al.; Garraffo). In this case, manufacturers compete in the final goods market but cooperate in the input market. In our model, this means that all the major organizations of the industry come together and jointly develop the IT standard. This way, each organization stakes a claim in the ownership of the standard but no one controls it. This can be thought of as joint multiple vertical integration.

The term joint multiple vertical integration is a logical extension to the term vertical integration, which means an organization integrates or acquires its customers or suppliers in order to avoid transaction costs associated with their opportunistic behavior. In our case, multiple organizations in the industry jointly own the IT standards or the standard setting body in order to avoid the monopoly premium. Hence, the distinction between monopoly and monopolistic supply. In coopetition, the standards authority is the only supplier and hence a monopolist, however, as it is controlled by its customers—the manufacturers—, it cannot supply the

standards monopolistically. If the standard authority did charge a monopolistic premium, it would go back to the manufacturers as royalty payments, they being the owners. Cooperation in a standards setting usually leads to an increase in the market pie (Bradenburger et al. 1996). Therefore, organizations in the industry cooperate to build the pie and compete to divide the pie.

The differences between internal provision in a competitive market, external provision in a monopolistic market, and cooperation are illustrated in Table 1.

	External Provision (Monopoly)	Internal Provision (Competition)	Cooperation
Number of Standards	1	Many	1
Number of Owners	1	Many	Many
Scale Benefits	High	Low	High
Price Premium	High	Low	Low

Table 1: **Benefits of Different Provision for IT Standards**

As the table shows, cooperation creates an industry structure with a single IT standard, but that standard is owned by all market participants (i.e. manufacturers). This alternative form of industrial organization is possible simply because their legal structures allow the number of owners of a standard to be different than one. This is a subtle but important fact that has not been widely considered in prior IT standards research. We illustrate this in Figure 4.

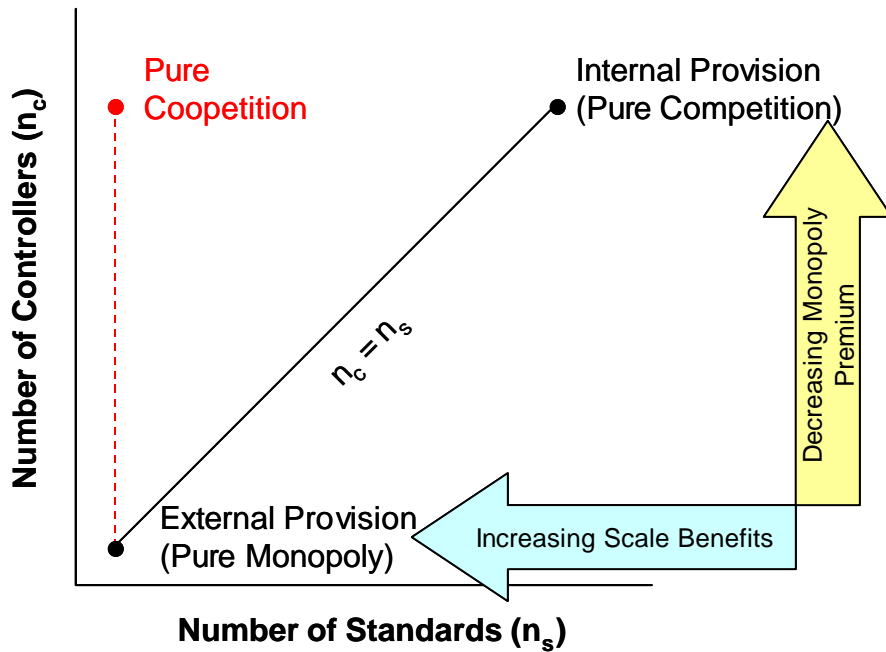


Figure 4: **Cooperation as a strategy with one supplier and many owners**

In Figure 4 we represent pure cooperation, pure competition and pure monopoly as archetypes. Any industrial organization in the graph is possible. However, in reality, we would talk about an industry being more monopolistic or more competitive or more cooperative, rather than the pure states. However, for theoretical understanding, a discussion of the pure states is simpler.

The actual ability of the industry to take advantage of the legal institutions that allow for joint ownership is facilitated by the fact that manufacturers of a particular set of IT intensive products are usually a concentrated group, numbering in the dozens, or hundreds, at most. That is why it is important to consider the manufacturers as the customers of the IT standard, rather than the end consumers who may number in the millions or even in the billions. The organizations that actually write the check to pay the monopolistic premium have the resources, knowledge and incentive to take advantage of these legal structures.

ILLUSTRATIVE EXAMPLE

We now provide an illustrative example in support of our theory. This is not to suggest that this is the only example, as there exists a wide variety of illustrative examples of cooperation for standards, such as the object management group's common object request broker architecture (CORBA)², The IEEE's P802.11 standards for wireless networking³, and the Open Mobile Alliance cell phone data transfer standards⁴. We build on prior literature (Dranove et al. 2003) and briefly describe the standards issues surrounding digital versatile disks (DVD). While Dranove and Gandall offer an excellent and detailed examination of standards issues from the viewpoint of the supplier of the standard, we look at the same standard from the viewpoint of the user of the standards. Thus, our work offers a comparison and contrast to their work in the same domain. We note that, in some instances, the user and the supplier are the same firm.

One early DVD standard was the super density (SD) format jointly developed by seven firms, including Toshiba, Hitachi Ltd., Matsushita Electric Industrial Co. Ltd., its subsidiary MCA Inc., Electronic Corp., Thomson Consumer Electronics SA, and Time- Warner Inc. This jointly developed and owned standard was aimed at avoiding the costs of a monopolistically supplied standard. As Toshiba puts it:

The aim of setting up the joint company is to help avoid doubling of royalty charges or unnecessary increases in license fees for users of the technologies... (Newswire December 04, 1995)

This early cooperation standard was challenged by a more monopolistically supplied standard, the Multimedia Compact Disk (MMCD), which was owned by Sony and Phillips, and based on Sony's proprietary audio CD standard. Compatibility with already accepted CD technology suggested the MMCD standard, but fear among the cooperation group, of monopolistic supply of that standard, suggested the SD standard. One industry observer describes the cooperation group's unwillingness to use the Sony standard, in this way:

Toshiba, Matsushita and their allies shunned Sony's initiative because they were still smarting from their bitter experience with CDs. They have been forced to pay huge sums in royalties for CD technology to Sony, which has an array of key patents shared with Philips. Sony presents its DVD format as an extension of the CD technology, raising the specter of vast royalties being demanded from licensees... (Newswire June 27, 1995)

² see <http://www.omg.org/gettingstarted/corbafaq.htm>

³ see <http://grouper.ieee.org/groups/802/11/abt80211.html>

⁴ see <http://www.openmobilealliance.org/>

Sony recognized that the increasing returns meant that only one DVD standard should exist. In his statement as the chairman of the Electronic Association of Japan, Sony Chairman Norio Ohga stated that the “existence of two standards was undesirable” (Newsbytes December 8, 1995). Eventually, Sony recognized the manufacturer’s resistance to a monopolistically supplied standard and joined the cooperation group along with Phillips and one other electronics manufacturers, bringing the number of members to ten and paving the way for the DVD standard.

History repeated itself not long after the DVD issue was resolved. Circuit City, lured by the prospect of being the monopolistic supplier of a high density optical storage device developed the Digital Video Express (DIVX) standard. DIVX was more technologically advanced than DVD. Not only could it play DVD movies, but it could also allow for single play disks. Single play disks can be used for a period of 48 hours and then become locked. This could effectively revolutionize the rental industry as the locked disks could only be unlocked with a purchasable code that can be downloaded from home, essentially turning a rental into a purchase or repeat rental. As a matter of fact, the concept of disposable disks has reemerged recently, only this time in jointly owned DVD format.

However, the intention of Circuit City was clear—to charge a monopolistic premium to manufacturers of DIVX products. Richard L. Sharp, Chairman and CEO of Circuit City Stores, Inc. relay the intentions of Circuit city in saying, “We believe the tremendous market potential Divx represents an opportunity for outstanding shareholder returns” (Newswire September 8, 1997). As Dranove and Gandal put it, “If DIVX became the dominant standard, Circuit City could extract a licensing fee from every unit of hardware and software. Circuit City could extract profits from all phases of the industry...” (Dranove et al. 2003).

As in the SD-MMCD case, manufacturers were wary of paying for a monopolistically supplied standard, and chose to go the cooperation route instead. After two years, Circuit City abandoned its attempt at DIVX, stating:

"We have always said that we had to have adequate studio support and additional retail outlets for software and hardware. We could not be the lone distributor or financier, those three components were not coming into play as we had envisioned. Despite strong consumer interest the risk and rewards turned in the other direction." (Kane June 15, 1999)

While both of the monopolistically supplied standards have been rejected, the cooperation-based standard remains. In fact, there are more than 200 members of the DVD standards body today. The interesting thing is that while these 200 cooperate to define and distribute the standard at a low royalty rate, the same firms are largely fierce competitors in the market for the sale of DVD technologies.

DISCUSSION

There are a number of IT standards in existence today and many of those are monopolistically supplied. Because IT standards form natural monopolies, manufacturers are stuck with them for the foreseeable future. However, there are also a number of new technologies on the horizon, for which IT standards will be required. Manufacturers have learned previous hard lessons from fighting standards wars and from paying monopolistic suppliers. In the future, when new technologies are developed, where IT standards are needed, we hope and expect that manufacturers will reject monopolistic suppliers and instead work together to create jointly owned industry standards through the strategy of cooperation.

If we have done our job, the reader is convinced that cooperation is a viable and valuable strategy. Given this, and the particular circumstances of IT standards—high up-front cost, high learning costs, and network externalities—it is essential that IS research investigate this strategy further. While this work offers a starting point, there is plenty of room for additional research.

We limit our discussion to IT product standards, which can generally be thought of as software. However, IT process standards are a significant and fertile field for additional consideration. As educators, it is imperative that we know which processes to teach. For industry, it is important to know which IT process standards to use. Process standards are likely to be different in several ways. Because they are rules for people, they will tend to be less precise and more flexible. Moreover, the marginal cost of training people in processes is not, by any means, zero. Finally, the lack of precision leads to much more difficulty establishing ownership of an IT process standard. Without a credible ability to establish ownership, there is no credible threat of monopolistic supply. In fact, it is difficult to believe that an IT process standard can be charged for—although the training can be changed, there is no licensing fee for the actual use of the process.

Another area that we have left for future research is the possibility of competition among two or more cooperations e.g. (Garraffo 2002). That is to say that, some set of manufacturers may cooperate for one standard and some others for a different standard. How would this effect the industry structure? It would seem that the chance of winning such a standard war would go up for all participants, though the benefits of being one of many winners would be less. Under some circumstances, this would seem to be a rational strategy.

We have assumed, throughout, that IT standards are characterized by network externalities. However, not all IT standards are. For example, DVD write technology does not possess the same level of network externalities as DVD read technology. The read technology allows all DVD products (players and disks) in a region to communicate. However, given the encoding standards, the method of actually writing the DVDs does not possess great network externalities. Similar arguments can be made for the level of externalities for operating systems and other system software, as compared to application software. This is a particularly fertile area for future empirical work.

This work has focused on the economic motivations, but the sociological issues in cooperation are equally important. Organizations often prefer to work with certain other organizations. Cooperations may be organized as temporary or permanent concerns. Academia could play an important third party role. Board interlocks and personal relations may be necessary (or detrimental) to the formation of a cooperation. The end consumers and government surely play vital roles. These are important issues beyond the scope of the work presented here.

CONCLUSION

This theory and example illustrates that the manufacturers who use IT standards as inputs to the production process have become cognizant of the fact that IT standards are natural monopolies. In order to garner the production efficiencies of a single supplier, without having to pay the price of a monopolistic supplier, these organizations are increasingly turning to cooperation. Many competitors, all of whom have need of the standard, cooperate with one another to jointly own and administer the standard. This leads to a whole new form of industrial organization that blurs the traditional boundaries of the firm and the traditional roles of firms within an industry.

Frequently, academic research assumes the customers of technology standards are millions of powerless, ignorant individuals. This is often incorrect, because the entities that actually write the checks to the standard authority are not individuals, but rather manufacturing firms. These customers are a handful of powerful corporations who are aware of the subtleties of business and have both the power and the incentive to avoid a single monopolistic supplier. We would suggest to those organizations who are fighting to be the monopolistic suppliers of an advanced technology standard, much like wolves fighting over a particularly fat sheep, to look again at the sheep and make sure it is not actually a rhinoceros, with no intention of being eaten.

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REFERENCES

- Arthur, W.B. "Increasing Returns and the New World of Business," *Harvard Business Review*, July-Aug 1996.
- Bradenburger, A.M., and Nalebuff, B.J. "Coopetition," *New York: Doubleday*, May 1996.
- Cargill, C.F. *Information Technology Standardization: Theory, Process, and Organization* Digital Equipment Corporation, 1989.
- Cusumano, M.A., and Yoffie, D.B. *Competing on Internet Time: Lessons from Netscape and Its Battle with Microsoft* Free Press, New York, NY, 1998.
- Dagnino, G.B., and Padula, G. "Coopetition Strategy A New Kind of Interfirm Dynamics for Value Creation," EURAM: Second Annual Conference - "Innovative Research in Management", Stockholm, 2002.
- David, P.A. "Clio and the Economics of QWERTY," *The American Economic Review* (75:2, Papers and Proceedings of the Ninety-Seventh Annual Meeting of the American Economic Association), May 1985, pp 332-337.
- David, P.A., and Greenstein, S. "The Economics of Compatibility Standards: An Introduction to Recent Research," *Econ. Innov. New Techn.* (1) 1990, pp 3-41.
- Dell, M. "Michael Dell on What Really Spurs Demand," in: *Business Week*, 2003, p. 18.
- Dranove, D., and Gandal, N. "Surviving a Standards War: Lessons Learned from the Life and Death of DIVX," *CEPR Discussion Paper No. 3935* 2003.
- Economides, N. "The Economics of Networks," *International Journal of Industrial Organization* (14:2) 1996, pp 673-699.
- Gallaugh, J.M., and Wang, Y.-M. "Understanding Network Effects in Software Markets: Evidence from Web Server Pricing," *MIS Quarterly* (26:4), December 2002, pp 303-327.
- Garraffo, F. "Types of Coopetition to Manage Emerging Technologies - Provisional," EURAM: Second Annual Conference - "Innovative Research in Management", Stockholm, 2002, pp. 1-14.
- Jacobs, K. *Standardisation Processes in IT*, (1st ed.) Vieweg, 2000, pp. 1-250.
- Kane, M. "Divx dies -- DVD the big winner," in: *ZDNet News*, <http://zdnet.com.com/2100-11-514913.html>, June 15, 1999.
- Kauffman, R.J., McAndrews, J., and Wang, Y.M. "Opening The 'Black Box' of Network Externalities in Network Adoption," *Information Systems Research* (11:1), March 2000, pp 61-82.
- Libicki, M.C. *Information Technology Standards: Quest for the Common Byte* Digital Press, 1995.
- Maier, M. "Chasing Bluetooth and Wi-Fi," in: *Business 2.0*, 2002.
- Mantena, R., and Sundararajan, A. "On Technology Markets That Tip: Increasing Returns, Competition, and Discontinuous Shifts in Consumer Valuation," presented at the 11th Workshop on Information Systems and Economics (WISE-99), Charlotte, NC, 1999.

- Newsbytes "DVD Consortium Reaches Final Agreement," in: *Post-Newsweek Business Information Inc.*, Tokyo, Japan, December 8, 1995.
- Newsire "Plug Pulled on Divx DVDs," in: *Associated Press Online*, New York, 1999.
- Newsire "Toshiba Proposes Joint Company to Manage DVD Licenses," in: *Kyodo News Service, Japan Economic Newswire*, Tokyo, Japan, December 04, 1995.
- Newsire "Industry Trend: DVD war Spreads to Computer World," in: *Jiji Press Ticker Service*, Tokyo, Japan, June 27, 1995.
- Newsire "Circuit City Stores, Inc. Announces Divx Partnership," in: *PR Newswire Association, Inc*, Richmond, Virginia, September 8, 1997.
- Orenstein, D. "Gates: Trust Microsoft to Improve the Web," in: *Business 2.0*, 2000.
- Shapiro, C., and Varian, H.R. *Information Rules: A Strategic Guide to the Network Economy* Harvard Business School Press, 1998, p. 352.
- Shapiro, C., and Varian, H.R. "The Art of Standards Wars," *California Management Review* (41:2), Winter 1999a, pp 8-32.
- Shapiro, C., and Varian, H.R. *Information Rules: A Strategic Guide to the Network Economy* Harvard Business School Press, Cambridge, MA, 1999b.
- Shirky, C. "XML: No Magic Problem Solver," in: *Business 2.0*, 2000.

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