Chapter 19

Managing Compatibility and Standardization

19.1 Compatibility Standards and Standardization

Compatibility standards have long played a significant role in many areas of the economy. Some examples are railway track widths, voltages, weight or length measurements or even transmission and communication protocols in telecommunication (Knieps, 2007, 117). The burden of defining, introducing and changing standards has so far been shouldered by engineers and lawyers; only recently has it come to the attention of economists.

Compatibility (Farrell & Saloner, 1987, 1 et seq.), often referred to alternatively as interoperability (Choi et al., 1997, 513), generally means that different systems (products, individuals or organizations) are capable of cooperating via a common point of intersection. Among such compatible systems are trains and tracks, hydrants and hoses, or cameras and lenses. Compatibility generally refers to two aspects (Knieps, 2007, 118). On the one hand, there is the compatibility of entire networks, e.g. of rail, telecommunication or language networks. If two networks are compatible on the basis of a common standard, such as the German and French rail networks, the extent of the direct network effects is determined by the sum of users of **both** networks. Conversely, this means that all agents that use a common standard form a network (Picot et al., 2003, 63-64). On the other hand, the availability of products that are compatible with a network is relevant. The more comprehensive and diverse the offer of such complements (e.g. rail vehicles), the stronger indirect network effects will be.

Considering examples such as PCs and their peripheral units, the different components of a stereo system including data carriers (CD, DVD etc.), the terminal devices in a telephone network or the internet, or even a common national language, they all fundamentally concern the exchange of information. One needs concrete specifications of a data carrier, such as a CD, or a telephone/internet protocol, in order to make communication possible. Even information exchange be-

tween two people requires a common standard. In Chapter 17 we have defined a (communication) standard as the totality of rules that form the basis of communication for people or machines (Buxmann et al., 1999, 134). In short, it is the rules that create compatibility.

Here we do not refer to standards of quality or security, that is requirements which a product or production must meet (Hess, 1993, 18 et seq.), or standards for reducing diversity (e.g. DIN A4) or information/product description standards (e.g. for describing fuels) (Blind, 2004, 20 et seq.). We are exclusively concerned with standards of compatibility.

A standard often stands for a technology, a method or a code that dominates the market, thus representing "the" standard (Burgelman et al., 1996, 311). This very narrow conception is not the basis of our considerations either, as it would blind out the development toward a standard and the competition of standards.

In connection with compatibility standards, there is often talk of technology, i.e. technical/technological standards. A very broad view of technology, such as the English language's, generally refers to procedural agreements, which are found in many areas of human activity, e.g. in service creation processes, but also, more generally, in human co-existence.

Compatibility between participating systems comes about via a process of standardization (Farrell & Saloner, 1987, 3). In such a collective process, the unification of intersections or protocols, a certain variant is selected from a pool of options and accepted by a certain amount of people for a certain period of time (Borowicz, 2001,14). Compatibility as a result of standardization thus means, in short, that products are able to work together.

19.2 Relevance of Standards

Why are standards so significant?

> Companies that have set industry standards, or are in a position to influence these, are able to achieve innovation profits that no other competitive advantage can come close to obtaining (Grant & Nippa, 2006, 437).

Standards play an outstanding role on information markets not only for this economic reason, but also due to technological aspects. Digital information goods always have a certain storage format, their transmission is subject to a format and even their output is technologically specified. This means that a functioning market offer of information goods always requires (communication/compatibility) standards.

In the days before the internet's prevalence, most standards were created by public institutions or legislative and administrative acts (of the post or telecommunication) as so-called de jure standards.

> In the internet economy, almost all standards are the results of processes of self-organization (the internet's self-administration) and of de facto assertion on the market (e.g. operating systems, browsers, communication services). Thus the process of standardization is given an entrepreneurial character (Picot, 2000).

Standards have become increasingly open to influence, meaning companies who have succeeded in setting standards–such a Microsoft and Intel (Wintel PC Standard), Qualcomm (CDMA Standard) or Cisco (IP Standards)–generate above-average shareholder value. For the IT world, it is generally to be assumed that it is changing from a product-based world to one based on standards. In such a world, it is not important who provides a program, only that it be able to process open formats (Postinett, 2009, 11).

19.3 Forms of Standards

In observing standards, one must take into consideration the supply as well as the demand side. Standards must first be developed by their providers; this is how they acquire ownership rights over it. Depending on the mode of access, one differentiates between provider-specific (proprietary) or cross-provider (open) standards (Ehrhardt, 2001, 12 et seq.). A standard is deemed **proprietary** if the network of products and complements applies to the technology of only one company. This is the case for video game consoles by Nintendo, Sony or Microsoft. Other manufacturers are prohibited from selling compatible hardware, precluding the possibility of substitution. If you want to play Halo 3, you must buy Microsoft's Xbox. As soon as companies form coalitions, one speaks of an **open proprietary standard** (Borowicz, 2001, 99). This can be a simple alliance of two companies, such as Philips' and Sony's for the CD-ROM format, or entire groups, such as the ones facing off over the succession of DVD. The decisive factor is that access to the technology is controlled by a company. If access to a standard is possible without any significant restrictions, this is an **open** standard. Examples for this are CD-ROM, ISDN, HTML or Linux. An open standard always means that intellectual access is free; usage, though, can very well incur licensing fees. These must merely be set in such a way that they represent no serious hurdle for access (Hess, 1993, 27; Maaß, 2006, 158).

It is definitely possible for several (proprietary or open) standards to compete for dominance on a market. If, however, an entire industry serves a unified standard, we speak of an **industry standard** (Ehrhardt, 2001, 13). Such a standard is found, for instance, on the market for stereo systems: equipment from the most diverse of manufacturers can be assembled into a functioning aggregate.

However, the demand side also plays an important role in the establishment of a standard. In the final analysis, the consumers decide on the actual acceptance and prevalence of a standard (Hess, 1993, 36 et seq.). Is there an industry-wide

standard dominating the market or are there fragmented standards that compete on a market? According to Suarez (2004, 281) a standard can be called dominant if

> (a) there is a clear sign that the most closely competing alternative design has abandoned the active battle, thus acknowledging defeat directly or indirectly;
>
> (b) a design has achieved a clear market share advantage over alternative designs and recent market trends unanimously suggest that this advantage is increasing.

Some dominant standards are VHS for video recorders, Windows for PC operating systems and the Adobe Portable Document Format (pdf). Further examples are shown in the table below.

Enterprise	Product category	Standard
Microsoft	Operating systems of PCs	Windows
Intel	Microprocessors for PCs	*86 series
Matsushita	Video cassette recorder	VHS system
Sony/Philips	CDs	CD-ROM format
Iomega	PC diskette drives with higher storage capacity	Zip disk drives
Intuit	Software for online finance transactions	Quicken
Sun Microsystems	Programming language for web pages	Java
Rockwell and 3 Com	56 K modems	V 90
Qualcomm	Digital mobile telephone communication	CDMA
Adobe Systems	General file format for the construction and account of electronic documents	pdf

Table 19.1: Examples of Companies who Control Standards. Source: Grant & Nippa, 2006, 437.

19.4 Determining Factors of Standardization

Whether there are several standards that compete for a market or whether a single standard will achieve dominance depends on both the supply and demand conditions. Shapiro and Varian (1999, 186 et seq.) detected two central factors that de-

cide whether a market tends to a single standard or not. They describe such markets as "tippy markets" (176).

Supply / Demand	Low Cost Degression Effects	Pronounced Cost Degression Effects
Homogeneous Customer Preferences	Low	High
Heterogeneous Customer Preferences	Improbable	Possible

Table 19.2: Standardization Potential. Source: Following Shapiro & Varian, 1999, 188.

Homogeneous customer preferences are the best precondition for the forming of a unified standard. If, in addition, there is interest on the provider's side, because increasing output quantity would allow him to significantly reduce his overhead, the probability of dominant standard emerging is to be deemed high. Both effects are often in effect at the same time, particularly for information goods (Shapiro & Varian, 1999, 189). The situation looks different when customers have very different desires and do not want to settle for a small amount of product offers. In this case, different products, and thus incompatible standards can stay on the market (Borowicz, 2001, 70). Apple's MAC computers have asserted themselves against IBM-compatible PCs up to this day because Apple users have certain demands on the product functionalities that have not been satisfactorily met by IBM PCs. Only recently has Apple begun trying to tap into its competitor's large installed base via the installation of Boot Camp, an additional, Windows-compatible operating system, on its computers.

The trend toward standardization is stronger in proportion to how pronounced the occurring network effects are (Stango, 2004, 3; Borowicz, 2001, 67 et seq.). These are, of course, ubiquitous in information goods, but can turn out weaker or stronger. While, for instance, the basic value is the most important aspect of standard business software, companies regard data exchange software (EDI) more from the viewpoint of whether their business partners also use it (Buxmann, 2002). In the second case, the specific product requirements are eclipsed by the network effect value. Standardized products are important for the customer in this case. A similar relation applies to the value of the basic good and the complements for the customer. Church and Gandal (1992) used a game-theoretical model to ob-

serve, on the example of software, that when customers highly value a diverse assortment of complements in comparison with the variety of the basic good of hardware technology, this will lead to a de facto standardization in the hardware market. Heterogeneous customer desires with regard to the complement of software, on the other hand, lead to the co-existence of different incompatible hardware offers.

The potential for standardization is more pronounced depending on the overall strength of the network effects, i.e. the higher the demand for intensive exchange (direct network effects) and/or complementary services (indirect network effects) is in comparison with the specific requirements to the basic good. Gupta et al. (1999, 414) thus recommend, for the analysis of markets with indirect network effects, to first analyze the competing basic goods, then the complementary offers as well as the complementors that offer them, and finally customer expectations with regard to their notions concerning both aspects (hardware and complement offer). Barring the suppliers, neglected here, this corresponds exactly to the constellation of the value net we proposed for analyzing information markets.

For planning standardization, providers must thus take into consideration three factors (Hess, 1993, 36 et seq.):

- The degree of standardization: how comprehensively should compatibility be created? What product functions should be standardized and to what other products or systems should compatibility be formed?
- The competitors' access to the standard: how open is access to the standard? How strongly is the product protected?
- The standard's prevalence with the buyers: how are the potential customers' standardization expectations being influenced positively?

Standards can be spread in different ways. If it is done via the market and without being legally binding, we speak of an informal or de facto standard. If standards are made binding by regulatory instances, like the government or standardization committees (Deutsches Institut für Normung: DIN, Comité Européen de Normalisation: CEN, International Organization for Standardization: ISO), this is called a formal or de jure standard (Blind, 2004, 17; Ehrhardt, 2001, 14).

The importance of attaining a high prevalence with the help of a standard for the success of a technology is shown by examples where new technologies failed due to incompatibilities. Ehrhardt (2001, 162 et seq.) here names the introduction of AM Stereo technology (Medium Wave) as well as Quadrophony, a four-channel-sound technology that was meant to replace stereophonic sound. Currently, we have the example of Digital Rights Management (DRM) in the music industry. Here the various providers of different technologies did not succeed in settling on a common standard.

> There have also been significant brakes on the digital music sector: the lack of interoperability between services and devices due to different providers' digital rights management (DRM) standards (Bundesverband Musikindustrie, 2008, 5).

As a consequence, the music industry has decided to forego DRM entirely and to offer music without any copy protection in the future.

19.5 Standards on Information Markets

The above deliberations already made clear why standards play a decisive competitive role, particularly for providers of information goods. This is down to two reasons: on the one hand, the use and exchange of information (goods) always presupposes compatibility. Secondly, standards are always important when goods with network effects are concerned (Grant & Nippa, 2006, 439). In goods that become more valuable for the users with increasing prevalence, standards have great advantages for customers and suppliers, but also for the provider. Let us consider the above example of DRM. For buyers of music, it is of advantage if there is a large user community using the same DRM technology. This increases the options for sharing music. Thus for example, all titles that users bought on iTunes were protected by the DRM system fairplay until recently. The protected titles are only compatible with the corresponding music players (iPods) and their software. A user of this software might discuss the music with users of another network, such as customers of the former online service Connect by Sony, but cannot share it. Here both direct and indirect network effects become visible: direct ones where data exchange is concerned and indirect ones with regard to the complements necessary for playing the music. This corresponds to two different forms of compatibility that can generally prevail for information goods, with regard to substitutability on the one hand and to complementarity on the other (Borowicz, 2001, 10 et seq.).

The size of a network depends on the quantity of available **substitutes**, for one. Gabel (1987, 94) here talks of "multivendor compatibility", as for example when hardware is characterized as IBM-compatible. Hence, if the single DRM systems and storage formats had been compatible, and thus substitutable, there could have been one single, large network of listeners. The struggle for a unified DRM standard for music is now over, yet the standard for the storage format is still being fought over. As long as various incompatible formats are used for storing music, there will be different networks that will prevent the direct network effects from blossoming.

On the other hand, the size of a network is influenced by the indirect network effects. They, too, can only come into effect if compatibility is a given, this time with regard to the available **complements**. An online music service thus has advantages if there is a large number of compatible products on which the buyers can listen to their music. The number of complements grows in proportion with the size of the respective network. In our example, two-sided (indirect) network effects even come into play when the number of iPod buyers buys the music offered on iTunes and, conversely, a large community of music listeners on iTunes leads to a greater wealth of variants in MP3 players.

Chou and Shy (1996) here developed a dynamic model, in which they observe the effects of exclusively incorporating third-party providers into the production of complements. In their model, the consumers can choose between two basic technologies (hardware), and their value depends–with a given budget–on the number of available complements (software). If the basic technologies are incompatible, the value for the consumers depends on how many complements are available for the platform in question. Due to their constrained budget, they will choose the cheaper basic product in order to have more money available for additional applications. An intense price competition between the providers of the basic technologies is to be expected. The case is similar when basic good and complements are available from a single source. Here, too, there is no impetus for the provider to raise prices in order to force those consumers who only request the basic good off the market (Economides & Viard, 2004, 3). This may also explain why Microsoft charges a lot less for Windows than for the Office package: users who want to use Windows together with other applications should not be scared off the basic good. With strong network effects, it can even be profitable to lower the price of the basic product to zero and to draw one's profits from the increasing requests for complements (Clements, 2002).

The logical consequence, then, is that incompatible offers and exclusive applications are more interesting for large companies than for smaller ones (likewise Haucap, 2003, 34, with a model-based analysis of the telecommunication market). They can try to force newcomers off the market, which they will probably accomplish if they have a strong head start on the market and the new provider's cost advantage is low (Maaß, 2006, 80 with further sources). Also of advantage for the established provider in this situation are a higher reputation and customer preferences in favor of his product (Katz & Shapiro, 1994, 111).

For smaller providers, it is thus recommended to open up and seek compatibility with the established competitor in order to draw on his installed base. Orienting oneself on the dominant standard further makes a price premium possible, which Gallaugher and Wang (1999) observe in an empirical analysis of the web server market:

> In a market where more than one standard can be employed, products that support dominant standards were shown to exert a price premium (Gallaugher & Wang, 1999, 83).

There is one danger to be faced, though: third-party providers of complements may develop few or no products that are entirely tailor-made for the newcomer's offer. Dranove and Gandal (2003) investigated the case of DD vs. DivX. DivX players had a one-way compatibility, i.e. they could read DVDs, whereas DVD players did not recognize the DivX format. It was thus more profitable for providers of the respective complements (films) to only offer the format both were able to use (Dranove & Gandal, 2003, 385). This again might lead to the basic product

being unpopular due to its lack of a multitude of specific complements (Chou & Shy, 1990).

The decision in favor of compatibility is thus at the same time a decision against an intra-standard competition. Katz and Shapiro (1986) investigated this in a model and arrived at the following conclusion:

> The most striking result is that firms may use product compatibility as a means of reducing competition among themselves. By choosing compatible technologies, the firms prevent themselves from going through an early phase of extremely intense competition where each firm tries to build up its network to get ahead of its rival (Katz & Shapiro, 1986, 164).

However, competitive intensity only decreases at the beginning of the product life cycle. In the case of compatible products, none of the providers will be able to dominate the market on his own, and so the competition's intensity will rise in later phases (Katz & Shapiro, 1994, 110 et seq.).

For the provider, the question of compatibility with others is a fundamental decision, which in turn leads to the question of whether he himself believes he is capable of creating a sufficient amount of network effects. The competition on network effect markets

> … is prone to tipping, there are likely to be strong winners and strong losers under incompatibility. Therefore, if a firm is confident it will be the winner, that firm will tend to oppose compatibility (Katz & Shapiro, 1994, 111).

19.6 Effects of Compatibility Standards

Apart from network effects, there is a series of further advantages that compatibility brings and which makes the establishment of a standard something to strive for. If a dominant standard exists, this will decrease both transaction and switching costs for the customers (Graumann, 1993; Picot et al., 2003, 64). Different product offers can be more easily found and compared. This means that the **decision time** is decreased and the **decision quality** rises. The costs for switching from one compatible product to another sink likewise. A printer does not become worthless if you buy a different PC, and you can also continue using your saved weblinks when switching browsers. In such cases, however, it must be noted that dominant standards may lower the switching costs for using the standardized products, yet at the same time significantly raise them with regard to alternative offers. Existing, but also future offers that are not compatible, will have a much harder time asserting themselves on the market. Dominant standards, no matter whether they are

open or proprietary, decrease switching costs within a standard but raise them outside of it. In this way, not only individuals but also industries, even entire societies can find themselves in a Lock-In, as has been the case with Microsoft Windows for some time (Shapiro & Varian, 2003, 57).

Established standards increase **decision certainty** for all involved: consumers, suppliers and manufacturers all have a higher certainty of their investments possessing long-term value and not leading to high switching costs in a short time. The higher the switching costs are, bringing the customer closer to a Lock-In, the longer a standard will prevail. Even solutions that are technologically superior or that are more user-friendly, cannot assert themselves if too many customers face prohibitive switching costs (in a Lock-In).

A much-cited example for this is the Anglo-American QWERTY (or German QWERTZ) keyboard (David, 1985). This allocation of keys on a typewriter, developed in 1873, aimed at a slow typing speed in order to avoid blocking the typebars in case of simultaneous keystrokes. Even though this problem could be solved technically, and a significantly more efficient and faster keyboard, the "Dvorak Simplified Keyboard Technology (DSK)" was patented in 1932, the originally introduced de facto standard has survived to this very day. As many millions of people have become used to a certain arrangement of letters, the switching costs are far too high for them to consider a new standard. This phenomenon, termed path dependency in the literature on strategic management, also makes providers shrink back from bringing a changed product onto the market.

High, or even prohibitive switching costs, lead to customers continuing to use the product once bought and not changing providers. The creation of such a standard is not necessarily, according to Arthur (1989), the result of a product's technological superiority, but is often due to chance ("historical events"). Products such as DOS, Java or VHS have become successful mainly because they had, at a certain point in time, a larger installed base than the competing products MAC OS, ActiveX or Betamax (Arthur, 1998). Thus it is not necessarily the better offer which will assert itself on the market–it can also be a worse product (seen in isolation, without considering network effects) or technology that reaches Lock-In.

Manufacturers as well as suppliers of a standardized good profit from a greater **market volume**. This means higher sales potentials as well as cost minimizing potentials in R&D, production or even marketing. A standard will solidify the market position of all providers involved and leads to market entry barriers for providers of diverging product standards.

19.7 Upwards and Downwards Compatibility

Specifically on network effect markets, a second dimension, apart from access to a technology, plays an important role for the provider: upward and downward compatibility ("multivintage compatibility"; Gabel, 1987, 94), or even vertical compatibility with other products or systems of the same provider. The company must determine whether a new product offer is compatible with existing offers in net-

works or whether it will break with the old standards, thus attempting to generate a new market, or to establish a new network. Next to the decision on compatibility with complements, this is the second aspect of the degree of standardization. This is a specific form of substitutability.

If a new product, e.g. a computer or a gaming console, is downwards compatible, software or games of the older model can still be used. Sony's Playstation 3 (PS3) originally offered **downward compatibility**. PS2 games could also be played on the PS3. In order to force sales of new games for the PS3, Sony ended the compatibility–much to the customers' sorrow–in late 2007 (Postinett, 2007). If users of the old product are, in reverse, not able to process protocols, files etc. of the new model, it lacks the corresponding **upward compatibility**. When Microsoft, for example, brought the new Word 97 on the market (Shapiro & Varian, 1999, 193-194), the Word 95 files could still be read but users of the old product were not able to process the new file type. Microsoft wanted to exploit its dominant market position and force all users to upgrade to the 97 version as quickly as possible. When this strategy became known, though, there were significant delays in the adaption and Microsoft had to release two free applications, a Word Viewer for reading the 97 files and a Word Converter for turning them into 95 files. The situation was similar in the case of Office 2007, which introduced entirely new formats (e.g. docx instead of doc for Word). The users of older Office versions were initially unable to process the new formats, and a corresponding converting tool had to be developed.

A great danger of the continued guarantee of compatibility is that new products lose performance ability. dBase is a good example for this (Shapiro & Varian, 1999, 192 et seq.). In order to stay compatible with older product versions, the newer versions contained ever more complicated hierarchies of programming code, which affected the performance. Microsoft was then able to use its relational database application Access to relatively easily assert a new, revolutionary and dBase-incompatible standard. The new product's performance ability was so much higher that Microsoft was able to develop its own large installed base even in the face of existing switching costs.

19.8 Strategies of Standardization

Both dimensions of standardization, that of access and that of compatibility, can be combined in a strategy matrix. Shapiro and Varian (1999, 191 et seq.) here see two possible alternatives: an evolutionary and a revolutionary strategy. The former offers a migration path, the latter breaks with existing offers while promising a much higher performance or value level. The evolutionary strategy has the great advantage of the installed base, i.e. all members of the network who use the same standard with all the corresponding network effects, still being usable. To proceed revolutionarily means to enter a new product on the market that is in competition with the previous standard. This was the case with Access vs. dBase. Subsequent compatible product versions of the same program are then, of course, part of an

evolutionary strategy. Innovations that create an entirely new market must be ascribed to the revolutionary strategy, though.

Evolutionary strategies always build on existing standards or previous versions of a product and bank on its further development. This can be driven by a single company (en bloc migration), as Microsoft or Adobe do with their respective new product versions. They are in control of everything. In order to share the risk more strongly, and to increase their chances of asserting themselves there are often alliances between several partners (controlled migration). This was the case with Toshiba and NEC, who created HD DVD, and Sony and Matsushita, who created Blu-Ray, both in order to supply the standard replacing DVD. There may be several parties involved, who have to reach an understanding as concerns the standard that is aimed at, but they can control the development jointly. If direct control is foregone, one is in the environment of open standards (open migration). These are freely accessible and can be used by everybody, be it in order to offer one's own standards (e.g. fax machines) according to this standard or to develop it further together with others, as is the case with Linux or Open Office.

Access / Compatibility	Proprietary – closed	Proprietary - open	Open
Compatible (evolutionary)	En Bloc Migration	Controlled Migration	Open Migration
Incompatible (revolutionary)	Power Play Discontinuity	Cooperative Discontinuity	Open Discontinuity

Table 19.3: Standardization Strategies. Source: Following Shapiro and Varian, 1999, 204.

If a new standard is created that is incompatible with existing products, technologies or conventions, one enters the field of discontinuous, **revolutionary strategies**. If they are pursued by a single company, we are dealing with the very risky Power Play strategy. There are many examples of an innovator trying to assert his standard on the market. Very successful examples, such as Apple's iTunes or the Nintendo Entertainment System in the eighties, stand opposite an equal number of cases in which a company completely failed to establish its standard. A prominent example is Sony with its Betamax video recorders, no longer existent today. In many cases, however, companies have succeeded in creating a durable standard,

which did not become the dominant industry standard but only play a supporting role. Among these companies are Palm with its Palm Operating System for Personal Digital Assistants (PDAs) and Apple with its Macintosh operating system, or also Sony's MiniDisc, which today is of significance only in Japan. Often, companies introduce their new, incompatible standards while banking on cooperation with others (cooperative discontinuity). This can be during the development phase, as for the CD (Sony and Philips), or also by licensing the format, as JVC/Matsushita did, when they were able to win Philips and Sharp, among others, in order to build up VHS as the dominant standard on the market for video recorders. Freely accessible, open standards to be newly introduced (open discontinuity) were the internet protocol TCP/IP, the text-based markup language for content on the Web (HTML), the MP3 format for compressing audio files, or GSM as a standard for digital cellular networks.

If several standards are in competition with each other and try to achieve dominance in order to become the industry standard, we also speak of a format war, or "Standards War" (Shapiro & Varian, 1999, 261 et seq.) In such struggles, there are different approaches to asserting one's own, preferred standard. They correspond with access rights and are differentiated according to whether a company strives to actively assert its standard as developer or technology leader, or whether it acts passively and conforms to a standard in the role of follower or adopter. The access to a standard is not, as above, a question of whether a new standard should be compatible with other products or not (evolutionary vs. revolutionary), but of whether one chooses to pursue the quest for market dominance either on one's own or in cooperation with others. The degree of openness itself is thus a strategic option (Grindley, 1995). Companies must thus consciously decide whether they want to keep their technology exclusively for themselves (proprietary–closed), open up part-way (proprietary–open) or make it accessible for everyone. In the proprietary-open strategy, the developer of a technology at least has the option of controlling access, granting or restricting it at his discretion. The proprietary-closed strategy always springs from marketary or market-similar (closed forums, consortiums etc.) competitive processes, whereas open standards are always the result of the work of recognized councils (including open forums). If access to a standard is public, it cannot be denied anyone (Borowicz, 2001, 99).

As a basic rule for a successful standardization, Hess (1993, 28) recommends making the licensing sufficiently generous for critical mass to be reached in any event.

> As anyone who has purchased property knows, the three guidelines for success in real estate are: location, location, and location. Three guidelines for success in industries where standards are important and increasing returns exist are: maximize installed base, maximize installed base, and maximize installed base (Hill, 1997, 10).

Access / Role	Proprietary-closed	Proprietary-open	Open
Active	Monopoly Strategy	Awarding Strategy	Sponsorship Strategy
Passive	Circumvention Strategy	Licensee Strategy	Copycat Strategy

Table 19.4: Behavior Options in the Standardization Competition. Source: Following Borowicz and Scherm, 2001.

19.9 Options of Proactive Behavior

The active behavior options of primary interest to us all aim at establishing a dominant standard. Network effects play the decisive role here (van de Kaa et al., 2007). There are two different approaches for a company: to initiate network effects via market processes, thus supporting the emergence of a de facto standard, or conversely, to strive for the negotiation of de jure standards. This will provide for a unified basis for the subsequent market offer and benefits the occurrence of network effects.

There are now a series of factors that influence the choice of one of the three active behavior options displayed in Table 19.4, in which the underlying legal conditions play an important role. If there is a regulator who sets the standard, all possibility of choice is precluded from the outset. If there is a preset standard, it must be noted whether protective rights (patents) may be established. The more comprehensively and effectively these can be used, the more a proprietary strategy will be favored. These two legal factors are widely prespecified, however, and cannot be extensively influenced by a single company.

More relevant are the factors that can be actively influenced by a company, also called success factors. These are subject to the (strategic) decision sphere of the individual company. They are viewed as the cause of a provider achieving dominance in the standardization competition with his chosen behavior option. Borowicz (2001, 113)–and, in precisely the same way, Suarez (2004), focusing specifically on information and telecommunication technologies–identify four of these: pricing policy, timing of market entry, signaling and organization of external rela-

tions. The first three factors are well known to us as action parameters in the context of information providers' competitive strategies, and will as such each be discussed in their own chapter. Only the **organization of external relations** shall be elaborated on a little more here. It can go in three directions: cooperation for the complement offer, for the offer of the basic good and in standardization councils. The discussion of complement management will follow in the next chapter. The latter two points have already been addressed at various points in the previous chapter. The various different associated aspects can be very clearly summarized via the example of the introduction of the Digital Compact Cassette (DCC) by Philips (Hill, 1997, 13). In 1992, Philips introduced its DCC technology on the market. To support this digital audio technology, Philips cooperated with Matsushita. Matsushita guaranteed the marketing under its own brand names Panasonic and Technics and provided a collection of recorded DCC cassettes via its in-house music label MCA. This measure meant that the central complement for the market introduction was available in sufficient amounts. The signal that Philips' music label PolyGram and MCA both banked on DCC was sufficiently convincing for a series of other labels to jump on the bandwagon, among them EMI, Warner and CBS.

This case exemplifies how varied the positive effects of an alliance can be. The basic technology can be distributed faster, potential competitors–who might (have been) develop(ing) their own products–can be won as cooperation partners, and at the same time, strong signals are being sent to the other providers to the effect that a new standard will probably assert itself. Market insecurity decreases and the readiness of other companies to invest in the development of complements rises. For a discussion of the risks and aspects of the formalization of alliances, e.g. in the form of joint ventures, we refer to the extensive literature on this subject (for an introduction Borowicz, 2001, 153 et seq., Ehrhardt, 2001, 137 et seq.).

Even though Philips did many things right in introducing DCC, and access to the technology was made open enough, DCC was not able to assert itself on the market because the buyers were not addressed enough. Although Philips invested a lot of energy to provide downwards compatibility (DCC players were able to play analog cassettes as well), there was a lack of purposeful marketing.

> Philips´ failure to establish the DCC as a new standard can be attributed in part to consumer confusion over the benefits of digital recording technology. Philips´ poor product launch advertising–which failed to mention the issue of backward compatibility and did not highlight the benefits of a digital recording technology–did nothing to dispel this confusion (Hill, 1997, 16).

Active Role / Success Factors	**Monopoly Strategy**	**Allotment Strategy**	**Sponsorship Strategy**
Penetration Pricing a) Starting Prices b) Price Development	a) Very low, close to variable costs b) Raise prices with increasing network effects and switching costs	a) Low, but higher than would be possible in a monopoly due to greater market power and fewer competing technologies b) Raise prices, but perhaps stay below monopoly price due to intra-standard competition	Penetration prices of secondary importance if the standardization council's reputations is high and there is no council competition
Price Differentiation (PD)	All forms of PD that facilitate network effects, particularly versioning and bundling	Product and price differentiation via company-specific offers	Regional PD, corresponding to the standardization council's sphere of influence
Timing of Market entry	Early (Pioneer) and building of barriers (e.g. installed base, distribution channels)	As early follower: Use of market power, financial power and capacities in order to offset the possibly already installed base As late follower only with significantly improved or advanced technology	Influence council's work in one's own favor (Beginning, Participants, Procedure)
Signalization a) Main addressees b) Signal contents	a) Customers, trade b) above all assurances, guarantees	Customers, trade	Councils
Cooperation Relationships (Alliances)	With providers of complements, if there is no solitary system provider	Competing providers of basic good and providers of complements	Competing providers of basic good, providers of complements and possibly standardization councils

Table 19.5: Success Factors of Active Standardization Strategies.

Additionally, Philips entered the market with relatively high end product prices ($900-1,200 per device) instead of pursuing a penetration strategy. On top of that, there was at the beginning only one kind of terminal device available, for home use; portable devices or devices for use in cars were missing. A further problem was probably the Minidisc, which Sony brought on the market as a competing technology at the same time (Hill, 1997, 16 et seq.).

This case makes it very clear how important it is to take into consideration all three factors for planning the standardization. In addition to the decision as to how extensively compatibility should be provided, it must be carefully planned in what capacity to involve the competition and how to address the demanders' side.

In closing, we will once more, briefly, take up the four success factors and summarize the central statements–allocated to the three active behavior options (Borowicz, 2001, 113 et seq.)–in Table 19.5, on order to show how they can be used in the standardization competition.

19.10 Options of Passive Behavior

If companies pursue a passive standardization strategy (see Table 19.4), their aim is to adopt another provider's standard. Their goal is market entry. Depending on the form of access, the following three passive options are available.

The **circumvention strategy** (Borowicz, 2001, 103 et seq.) is used by companies who want to gain access to a proprietary technology, which the holder does not want to provide. He is keen on keeping this information good exclusively to himself and not letting it become public property. As we have already found out in Chapter 3, the exclusion principle can be asserted for information goods only via secrecy or legal protection (e.g. patents). In order to get the desired information anyway, the copycat may get a hold of the parts of an information good that are for sale and try to imitate it. Such reverse engineering would mean, for example, buying software and trying to recreate it. Here it is difficult to decrypt the secret parts of the software, as the source code or specific interface information are not typically provided by the manufacturer. Information that are not offered on the market would then have to be appropriated in other–more or less legal–ways, by spying on the monopolist or directly poaching knowledge carriers. If information goods are freely accessible but patent-protected, there is the possibility of challenging or leveraging the patent. If the patent is still undergoing the examination procedure, a competitor may try to prevent its acceptance by contesting it. One may file a suit against existing patents or try to circumvent them by engineering around. An extensive empirical analysis by Debons et al. (1981, 913) showed that–even if patenting generally increases the cost of imitation–60% of patented innovations were circumvented within four years.

If the holder of a technology pursues a proprietary-closed approach and lets other companies share in while being controlled by him, an interested company may choose a **licensee strategy** (Borowicz, 2001, 105 et seq.). The following aspects are of note for licensing:

The decision on the degree of exclusivity that is striven for and the time of licensing have a particularly large effect on risk and market position. The more exclusively and the earlier licensing is completed, the greater the licensee's entrepreneurial risk will be, as the market is not yet fully developed. His risk situation then resembles a first mover's. The broader and the later one invests in a technology via licensing, the smaller the risks, but also the chances of economic success will be.

Degree of Exclusivity	Exlusive license (usage only by licensee)	Semi-exclusive license (usage only by licenser and licensee)	Simple licenses (right to use the technology alongside others)
Time of Licensing	Before market entry	After market entry, before standardization	After standardization
Extent of Licensing	Individual license	---	Package license
Licensing Compensation	Flate rate	Running costs	License exchange

Table 19.6: Aspects of Licensing.

The passive **copycat strategy** (Borowicz, 2001, 108 et seq.), corresponding with public access, is not, as the former two do, subject to marketary processes but is powered by the adoption of standards that have already been approved and made publicly accessible by councils.

19.11 Opening a Standard as Trade-Off Issue

As we can see, active and passive behavior options have different goals in the standardization competition. A passive behavior is directed toward market entry. As a consequence, there is an intra-standard competition, a **competition within the market** between providers of the same standard. If the offers are reciprocally

compatible, network effects only occur with regard to the entire market, and not for the individual provider.

Active behavior options aim toward the inter-standard competition, i.e. the **competition for the market** (Borowicz, 2001, 112). Here network effects are of great significance for the individual provider and must be taken into consideration when choosing one's strategy. Shapiro and Varian (1999, 186-187) demonstrate this via the example of internet service providers (ISP). In the early days of the internet, AOL, Compuserve and other ISPs offered proprietary services such as e-mail or newsgroups. It was very complicated, or even impossible, to send an e-mail from one provider to another. The customers were thus very interested in belonging to a large network. The commercialization of the internet has led to the availability, today, of standardized protocols for browsers, e-mail or chat applications, and the network one affiliates oneself with does not affect transmission anymore. The competition for the ISP market has made way for a competition within the market. The establishment of common standards has led to an integration of the different networks.

However, network effects can also be revived on standardized markets, if new technologies are developed. These can either satisfy given needs better, or also satisfy completely new needs, thus creating a new market. AOL is an excellent example with its instant messaging system ICQ. In order to use this proprietary technology, one must become a customer of AOL after all. As long as the different instant messaging services (e.g. by Yahoo! or Microsoft) stay incompatible with each other, network effects are again of great importance. Whether a new, incompatible offer will win the struggle is fundamentally dependent on whether the (old) users are in a Lock-In. Even if the new offer is better, a Lock-In can prevent its market acceptance. More on this in Chapter 23.

As we have seen, a provider must think very carefully about what sort of competitive situation to commit himself to. Any opening of a standard has several consequences. The competitive relationships will, in all probability, be positively affected: if several companies cooperate on the basis of a(n) (proprietary-)open technology, they will be more likely to succeed, as a faster assertion on the market and a greater market volume are to be expected. However, the higher competitive intensity brings along several disadvantages for the single provider. He must take into account lower market share and, over the course of the product life cycle, a stronger price competition, i.e. lower contribution margins (Grindley, 1995, 45 et seq.). This relation is schematically represented in Figure 19.1.

If we express this in a simple formula, we get (Grindley, 1995, 45 et seq.):

Potential Gains = Market Size x Market Share x Contribution Margin

The decision in favor of more openness thus means a trade-off between a greater market volume on the one hand and a stronger competition within the market on the other hand. The latter has a positive effect for an individual provider on balance, if he has been able to assume a dominant position in the competition or the

market has developed so positively due to the standardization that it overcompensates for the provider's loss of market share.

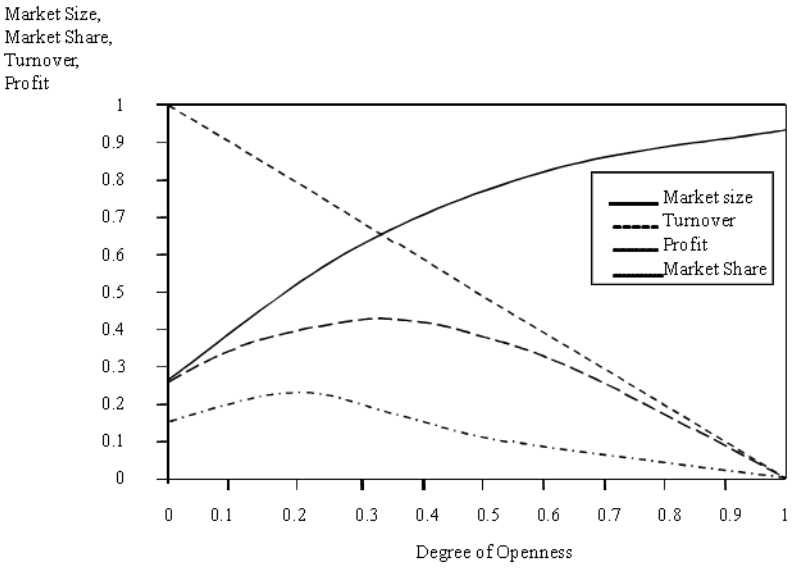

Figure 19.1: Effects of the Opening of a Standard on Sales and Profit. Source: Following Grindley, 1995, 46.

Specifically for the allotment strategy (Table 19.4), there is also the recommendation by Economides (1996) to make the licensing fee dependent on the strength of the network effects. The stronger the expected network effects are, the lower the licensing fees should be set in order to quickly reach critical mass and to initiate positive reinforcing effects. In case of very strong network effects, he even recommends not only the granting of licenses free of charge but their subsidization.

Similarly to the discussion of market entry strategies, we can say for standardization, too, that standards, once established, do not guarantee any lasting competitive advantages or monopoly positions (Borowicz, 2001, 55 et seq.). The material and immaterial investments of all parties involved may work toward a Lock-In, but the market and technology development can make a standard obsolete in a short time. The software-as-a-service offers or the Open-Source movement, with Linux and Open Office, are examples of how quickly established networks can run into difficulties. Here, too, it must thus be noted that the providers' power of innovation and potential for renewal remain of critical importance.

19.12 Conclusion

Only available in the printed version.

19.13 Bibliography

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