Chapter 3

Economic Particularities of Information Goods

3.1 Market Failure for Information Goods

Information goods are goods that display particular economic characteristics, which can easily lead to market failure. Market failure occurs when

> the result of marketary coordination deviates from the economically ideal allocation of goods and resources in the model of complete competition (Gabler 2010a).

If we followed the micro-economic standard textbooks, we would even have to assume that no market for information goods could develop at all. Some examples to make this problem clearer:

For information goods, the creation of the first copy is extremely expensive when compared to its reproduction. If we consider the production costs for a piece of music or a film, we will quickly run up several hundreds of thousands, even millions, of Euros. Once the album or the films are finished, however, more or less perfect copies can be made for a few cents each. Furthermore, the transmission costs of digital information goods are extremely low. If there is a fast internet connection, run on a flat rate, files can be received and sent with no additional cost, no matter what their size is.

- From this sort of cost structure, problems arise for the working of information markets: which company is going to offer goods that require large sums in order to be produced, but for which it is unclear whether enough units will eventually be sold in order to recoup those costs? Big providers with a large market share are clearly in advantage here. What makes things worse is that the copying costs are low not only for the legal, but also for the illegal user, and that one must always account for the dissemination of bootlegs hurting one's legal business.

The value of an information good, e.g. of the blueprint for a new production method or of a chemical formula, can only be conclusively assessed after the information has been received and processed (learned). If one then possesses the information, it remains to be seen how high one's willingness to pay still is. Unlike a pair of shoes, information cannot be inspected in their entirety prior to purchase. Each kind of precise inspection means a divulgence of (parts of) the information, and this is frequently against the provider's interests.

- This again leads to problems for a functioning information market: which provider wants to be active on a market where you have to surrender your product to be processed by the receiver prior to purchasing? On the other hand, which customer wants to buy a product without being able to see it, and thus precisely assess its value?

It is often of great importance in buying an information good to note how many other users the good already has. Whoever wants to buy a text processing or spreadsheet application will consider carefully whether he settles on the product of a small provider, which is not very prevalent, or on the market standard. To buy the most widely used program has clear advantages for file-sharing and provides options for mutual assistance in case of any problems in operating it. The case for films, books or music is similar, i.e. many buyers settle on content known by many others in order to have a say.

- Problems that arise for a functioning information market here are: what provider wants to enter a new market in which customers, in case of doubt, will rather buy a highly popular than a high-quality product? Established providers have significant advantages.

Information goods can be used by many people without being used up, i.e. consumed. An information good is not reduced by usage. If a person acquires a certain knowledge by processing information, this will not reduce another person's chances of acquiring the same knowledge. In contrast to many other goods, say a pair of shoes or a chocolate bar, the same information can be used by a multitude of people at the same time. Wear-out effects only occur for information that derives its value from not everybody having it. The insider's tip for the small Caribbean island quickly loses its value if everyone knows about it. For many pieces of information, however, there is no competition in terms of their usage, from the provider's perspective: for him, it makes no difference whether 6,000 or 600,000 people read a magazine or watch a TV show, e.g. the Academy Awards ceremony.

However, restrictions can be imposed via the information's packaging: a book can only be read by one reader at a time as a matter of principle, and the number of viewers of a TV show in one household is limited. However–compared to traditional goods–it is disproportionately harder to exclude customers who are not prepared to pay for the information from its usage: a book can be borrowed at little to no expense from a friend or the library, a TV show can be seen at someone else's house or recorded by a friend for later playback.

- For lack of exclusion options, the following problems apply for a functioning information market: who is prepared to offer goods on a market where it can be ascertained only with difficulty, if at all, that the buyers

actually pay for their usage? And what customer will pay for a product that he could also have practically for free?

Economically speaking, the following particularities apply for information goods (Varian, 1998; Hutter, 2000; Gerpott, 2006, 318 et seq., Linde, 2008, 14 et seq., similarly Klodt, 2003, 111 or Buxmann & Pohl, 2004, 507.):

- Information goods have strongly **decreasing average unit costs** (First-Copy-Cost effect), because the attributable costs of production dominate the variable costs of reproduction.
- Information goods have few pronounced search qualities, but the more heavily pronounced **experience and credence qualities**, respectively.
- Information goods have the characteristics of **network effect goods**.
- Information goods have a strong tendency toward so-called **public goods**. Consumer rivalry, per definitionem, is absent and the principle of exclusion can be applied only with difficulty, if at all.

Information goods thus display characteristics that make the occurrence of a market difficult, or at least lead to the market results being suboptimal. The economist here speaks of market failure. What this means in particular–analyzed economically–will be discussed in the following sections in more detail.

3.2 First-Copy-Cost Effect

For many traditional goods, particularly industrially manufactured ones, there are both fixed and notable variable costs (e.g. Meffert, 2005, 508). As opposed to the costs for production and facilities, those are, in the example of the manufacturing of a new laptop computer, all costs that occur in direct relation to the manufacturing of a single product: e.g. drive, chassis, processors. For information goods, on the other hand, there is a strong shift to fixed costs. In publishing houses, the costs of producing the first copy (incl. author's fee, cover design, typeface etc.) eclipse the costs for the following copies (incl. paper, printing, binding etc.) by a large margin. The use of different data carriers during reproduction also results in different costs. Thus for Microsoft's Encarta, the reproduction and distribution costs for the book version were $250, as opposed to $1.50 for the CD-ROM version (Downes & Mui, 1998, 51). Another example: where the production of a music CD can easily cost tens of thousands of Dollars, the variable costs of making copies are entirely negligible. The traditional distribution of music, via audio CDs, presents the music industry with variable costs of around €0.50 per copy (Buxmann & Pohl, 2004, 507; Wetzel, 2004, 205). In comparison, digital goods may even be offered more cheaply than that, particularly when the receiver shoulders the costs for distribution, or downloading, himself. The difference between the costs for the first and the last unit depends on how immaterial the product is (Stewart, 1998, 170). The first copy of Netscape Navigator, for instance, generated around $30m in development costs. The variable costs of the second copy, on the other hand, were only around $1 (Kelly, 2001, 85).

This relation between very high fixed costs and very low variable costs leads to a pronounced fixed cost degression. This means that the fixed costs per unit sink very fast as production numbers increase. On the example of Netscape, the development costs of $30m for the first copy, spread out over all units produced, would already be halved into $15m apiece for two copies. For four copies, they would only be $7.5m, and for 100,000 copies only $300 apiece. This extremely pronounced degression effect is called the First-Copy-Cost effect (FCCE) in media economics (Grau & Hess 2007, 26 et seq.; (Beck, 2006, 2224; Kiefer, 2005, 169).

There is no notable fixed cost degression for information goods with high development costs that cannot be reduced via high production numbers. This is the case for individual software, for example.

Usually, any consideration of the costs includes not only fixed but also variable costs. If fixed and variable costs are related to a produced unit, we speak of average costs.

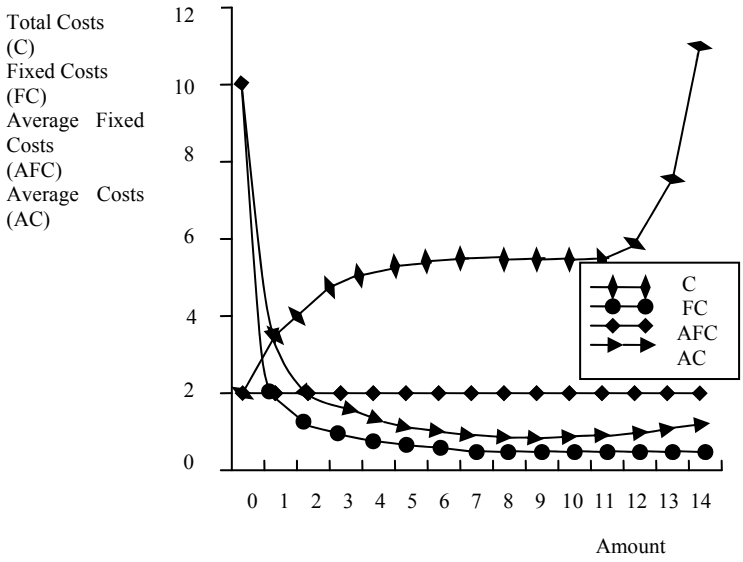

Figure 3.1: Typical Cost Behavior Pattern for Standard Goods.

As a rule, it is assumed for standard goods that average costs show a more or less pronounced u-pattern for companies with increasing levels of output (cf. fundamentally Mankiw et al., 2008, 297 et seq., with empirical data on cost behavior patterns in companies cf. Diller, 2008, 87 et seq., Kiefer, 2005, 173 et seq. and Simon, 1998, 14 et seq.). The total (fixed and variable) costs of production are divided by the amount produced, which results in said average costs. For the fixed

costs, the degression effect described above applies, as they are spread over more and more units. The decreasing average fixed costs result in a relatively fast decrease in total average costs. If the variable costs of every additionally produced unit are constant, or even decreasing, this will work in the same direction as decreasing average costs. If variable costs increase over the course of production, which is sooner or later to be expected for standard goods the degression effect of the fixed costs will be overcompensated for from a certain point on and average costs will rise.

The more strongly the average variable costs fade into the background behind fixed costs, the closer the course of the (total) average costs will come to that of the average fixed costs. In the extreme case scenario of $0 of variable costs, both curves will even be coextensive.

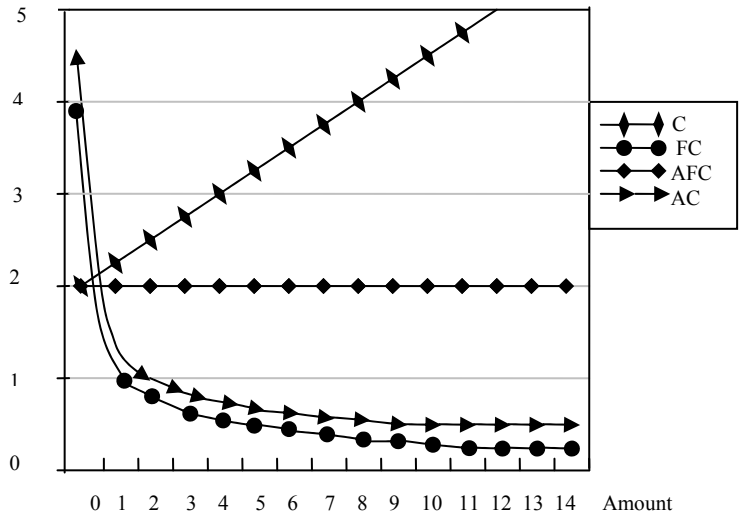

Figure 3.2: Cost Behavior Pattern for Information Goods with Constant Variable Costs.

If average costs decrease continually even as production numbers increase, this is called, in economics, (increasing) economies of scale. Economies of scale (e.g. Woll, 2008, 690) refer to changes in the output (production yield) due to proportional variations to all factor inputs for a given production technology. If the production amount increases proportionally/disproportionally/subproportionally to the additional factor input, we speak of constant/increasing/decreasing economies of scale. The causes for increasing/decreasing economies of scale are decreasing/increasing marginal products. In this case, it is desirable for the individual provider to expand his production amount as far as possible. Precisely these econ-

omies of scale occur for information goods, due to the high fixed costs for the first copy and the very low variable costs for all subsequent ones (Kulenkampff, 2000, 60). The very pronounced cost degression is reinforced significantly by the new information technologies. Transmission costs in particular decrease dramatically, as the provisioning and downloading of an .mp3 file, for example, are much cheaper for the provider than the production and distribution of a CD. Very little changes in the development and production costs, though (Klodt & Buch, 2003, 79 et seq.). These two cost aspects–provisioning costs and transmission costs–which are near zero, also represent the basis for the existence of online filesharing sites (Buxmann & Pohl, 2004, 507, 514 et seq.).

3.3 Information Asymmetries

In a traditional transaction of goods, e.g. of clothes, food or electronic devices, the customer has the option of inspecting the object in question. He will observe it, take it into his hands and perhaps even try it, or test its functions. All of this is difficult for information goods. In order to really be able to estimate their full value, one must first process the information. If we draw an analogy to a visit to a restaurant, one would first have to eat the food and then announce one's willingness to pay, i.e. one would determine oneself how much the already eaten food was worth. It is obvious that this can always be misunderstood as an invitation to a free, or at least very cheap, meal. The providers of information goods face a similar problem: if they surrender the information they offer, there will be insecurity as to the value their recipient will ascribe to it, and how his willingness to pay for the already consumed good will develop. If, on the other hand, the provider does not allow the consumer to test the information, that latter has to buy the pig in the poke and will probably either completely forego the purchase or–in view of his insecurity about the information's quality–have a lower willingness to pay than if he had been able to safely assess the quality. In such situations, we speak of asymmetric information distribution: there is a gulf between the information distributed to the suppliers' and to the demanders' side. When one side of the market is better informed than the other, this opens up vistas for exploiting this gradient strategically, e.g. by offering low-quality goods. This phenomenon of asymmetric information distribution mainly relates to the quality of the product on sale (Kulenkampff, 2000, 127). Asymmetric information distribution can also, however, relate to the allocation of product prices on the market, demanders' preferences (Klodt & Buch, 2003, 92 et seq.) or–as we will explain in more detail in Chapter 22–strategic market communication.

3.3.1 Information Asymmetries on Markets: The Market for Lemons

The analyses of George A. Akerlof (1970) have been fundamental for all further works on the subject of asymmetric information distribution. He was the first to exemplify the phenomenon of asymmetrically distributed information, on the ex-

ample of the used-car market. The seller of a used car is very well informed about the state of his vehicle on the basis of having driven it in the past. The buyer, on the other hand, merely knows that there are cars of various qualities on the market. He can thus only make an estimate concerning the average quality. If a symmetric information distribution were at hand, i.e. if both sides of the market had the same amount of information about the product on offer, one could easily set a price for each car based on its quality. As this is not the case, the seller has the option of exploiting this, by taking his low-quality car, advertising it as a good car and selling it at a higher price than would be adequate. Akerlof (1970, 489) calls these vehicles "lemons". The demanders, who are unable to assess the quality on offer on this market, will only be prepared to pay a price that meets their expectations. This can be illustrated via a simple numerical example (Varian, 2007, 827 et seq.).

Let us assume the following for a used-car market: there are 100 buyers and 100 sellers of used vehicles, and everyone knows that 50% of the cars on offer are of low quality (lemons). The quality of each individual car is only known to the sellers, i.e. this is a case of an asymmetric distribution of quality information. The sellers of the lemons are prepared to sell them for €1,000. The sellers of the good cars want at least €2,000. The buyers would pay €1,200 for lemons and €2,400 for good cars. If the quality could be easily assessed, we would get prices between €1,000 and 1,200 for lemons and between €2,000 and 2,400 for good cars. If the quality cannot be assessed, however, the buyers must try to estimate the value of the car in question. If the consumers generally derive the quality from the price, this will result in a uniform price that is oriented on the average quality (Graumann, 1993, 1337). In order to determine this price, the economist will calculate a so-called expectancy value, which is an estimate concerning a chance result to be expected. For the same probability of one of the two quality levels posited above, the rational buyer will be prepared to pay the expectancy value of the cars: ½ * €1,200 + ½ * €2,400 = €1,800. Which leaves us with the question: who would sell his car at that price? The lemon-sellers would be prepared to sell for €1,800, but not the sellers of the good cars, as they are aiming for at least €2,000. The consequence: at this price, only lemons would be sold. The situation becomes even more dramatic when the buyers can see that the price they are willing to pay is only met by lemons. Why? They would have to lower their expectancy value again, which in the extreme case would mean: 1 * €1,200 + 0 * €2,400 = €1,200. The buyers would then only be prepared to pay €1,200 at most. The consequence is that no good cars would be offered on this market. This result is particularly remarkable as there is definitely a willingness to pay for good cars (namely €2,400); it just does not take effect, because the necessary information for assessing the quality is missing. We are looking at an acute case of market failure, i.e. the result of marketary coordination deviates from the ideal result derived with the help of a reference model. The ideal result would be that all cars, good and bad, are sold at their respective prices.

What is so special in this case is that we have to expect not just a few mispurchases, where the buyer is disappointed to find out that the car he has acquired is a lemon, but that it is to be feared that not a single higher-quality vehicle will be

sold. Why is that? If a person tries to sell a bad car, and this is discovered after the transaction, this will influence the buyers' perception of the average quality of cars available on the market. They will lower their expectancy values, and thus the price they are willing to pay for the average car. This in turn puts the sellers of good cars at a disadvantage. The cars that will most probably be sold are the ones that their owners most want to get rid of. In summation, it can be said that when too many units of low quality are on the market, it will become difficult for providers of quality to sell their products at a reasonable price (Varian, 2007, 829).

What can we derive from this model? What we have here is the phenomenon called Adverse Selection in economics. The terms "Adverse Selection" and "Moral Hazard", which we will consider at a later stage, spring from insurance economics (Molho, 2001, 9 and 46 et seq. with further "lemon" examples in the context of experimental studies). The so-called Principal-Agent theory deals extensively with this problem (e.g. Richter et al., 2003 or, with a specifically economical perspective, Jost, 2001). The fact that one side of the market, in this case demand, is inadequately informed about the quality of the goods on offer (Hidden Characteristics (Göbel, 2002, 98 et seq.)), and that this information deficit cannot be made up for via search activities, the result is–due to the quality estimates that were made– Adverse Selection. The good offers are ousted by the bad. A general consequence of existing information asymmetries is thus that good quality is superseded by bad quality.

In the extreme case, it can come to the wholesale destruction of the market, namely if the providers–other than in Akerlof's fixed-quality model–can determine the quality they offer themselves (Varian, 2007, 829 et seq.). In this scenario, the (dishonest) providers of low quality–they are dishonest because they demand premium prices for poor quality–will not only drive the (honest) providers of good quality from the market, but in the end break the market itself, when it becomes clear that the (low) quality on offer is linked to too high a price. The downward spiral of the step-by-step withdrawal of quality providers will lead not to partial but to complete market failure.

3.3.2 Information Asymmetries on Information Markets

Let us now turn to information goods. Analogously to the above considerations, it will also be the case for information goods that there will be providers of good quality and providers of poor quality on a market. High-quality offers will be those that meet demanders' expectations. Hence, poor offers lead to disappointed expectations. If the demanders are not able to determine the quality of the offer from the outset, providers will feel the impetus to sell "lemons", advertising poor quality as good and thus increasing their profits.

If, furthermore, the manufacturing costs for poor quality are lower than they are for high quality and the provider can assume that the demander will not be able to assess it–at least prior to purchasing–it makes economic sense under profit maximization conditions to produce poorer quality at lower cost and offering it as high quality. It is also evident, though, that that this only makes sense as long as the

demanders allow themselves to be deceived, which can only be assumed, permanently, if either the buyer is unable to assess the quality–even post-purchase–or if the product is a one-off buy and there is no exchange of consumer experiences between the demanders. However, the buyer does have the opportunity for a quality experience, particularly if it is his first buy, i.e. if future buys from the same provider are still an option. As long as he is able to assess the quality, this will lead to his willingness to pay for future products being lowered and even–should he share his experiences with others–influence that of other demanders into the same direction. If this occurs, it will lead to the same downward spiral that Akerlof already described for the used-car market. Due to information deficits on the part of the demanders, Adverse Selection occurs, as a consequence of which the poor-quality offers increase at the expense of high quality.

Such an information-deficit-induced market failure occurs on markets for information goods, when the demanders are unable to acquire the necessary quality information (Hopf, 1983, 76). If we disregard the generally undesirable variant of having to make these unpleasant experiences oneself, they can only be avoided by searching for decision-relevant information. Economically speaking, this information gathering is pursued until the marginal cost of acquisition is equal to the marginal utility of the information acquired (fundamentally Stigler, 1961). Put simply, one puts up time and money for the information search–e.g. by buying consumer magazines or talking to other buyers–as long as the result is beneficial. This benefit can be a discount for the product, or the ability to better assess the quality of different offers, allowing the buyer to choose the better quality. It is evident that the benefit (marginal utility) is significantly higher with the first consumer magazine bought than it is with the twelfth.

Information goods display the peculiar characteristic that the acquisition of further information about an information good is principally to be deemed equal to the successive acquisition of the good itself (Kulenkampff, 2000, 129). The more intensively one informs oneself about a specific information good, the more one comes to know about its content. For software, one must differentiate between the application level and the source code level. On the level of the application, the common user can comprehensively inform himself without owning the software. If the user acquires access to the source code, however, he will be in possession of the entire good. If he is then fully informed, this would mean, as a last consequence, that he no longer needs the original information since he already has it. This phenomenon occurring with information goods is called the "information paradox" after Kenneth J. Arrow (1962, 615):

> [...] there is a fundamental paradox in the determination of demand for information; its value for the purchaser is not known until he has the information, but then he has in effect acquired it without cost.

The occurrence of asymmetrically distributed information is particularly pronounced for information offers. Hopf (1983, 76), following Akerlof, describes in-

formation as a typical "lemon" good. The providers have a strong head start in information compared with the demanders. On the other hand, the demanders can only really inform themselves about the information good if the provider makes it available–at least partially–prior to purchase. If he doesn't, the buyer will only be able to assess the quality post-purchase, by processing the information.

A very apt example for such a situation can be found on the markets for technical knowledge (Klodt, 2001a, 41 et seq.). The existence of the information paradox is the cause, here, of the subordinate role played by industrial contract research (i.e. awarding R&D assignments externally). The majority of (large) companies prefer to produce their technical knowledge internally, because they have insufficient control over the quality of the execution and the results. It is almost exclusively smaller businesses who use the possibilities of external contract research, as they shy away from the high fixed costs of having one's own R&D department.

3.3.3 Search, Experience and Credence Qualities of Information Goods

Information, following Arrow, is subject to a paradox: the value of an information good cannot be assessed prior to purchasing without getting to know at least parts of the good itself. Having complete information about an information good, though, would mean having the good, which was meant to be bought, for free. The transmission of information before the transaction creates the problem that as a provider, one can no longer know how high the buyer's payments will be, or if he will pay at all. Contrary to Arrow's allegation, the demanders–if not all of them–definitely have a willingness to pay, even after they have already acquired a(n information) good. In Chapter 18, on Pricing, we will address this under the keyword Reverse Pricing.

As the quality of information goods generally reveals itself only after the purchase, they are often labeled experience goods (Shapiro & Varian, 1999, 5 et seq., 2003, 117 et seq.). **Experience goods** are, according to Phillip Nelson, all manner of goods whose quality characteristics are only revealed after having been bought. For **search goods**, on the other hand, the quality can be ascertained before, via a simple inspection (Nelson, 1970). A third feature that goods can have, according to Darby and Karni (1973), are so-called **credence qualities**. Some examples for this are the services rendered by a doctor or a mechanic, which the consumer cannot entirely assess with regard to their quality even after they have been completed. He can only trust that cost and benefit were adequate.

Now many goods display all three of the above-named characteristics. Even if we are tempted to spontaneously label a daily-needs good, such as a loaf of bread, as a search good, i.e. a good whose quality we can assess in its entirety prior to purchasing via a simple looking-over, a closer look will soon show that here too, experience and credence qualities can be found. Where the color of the crust and the smell may still be search qualities, the bread's taste is already an experience quality that only transpires after the purchase, by taking a bite. Whether the bread has in actuality been biologically produced, as advertised, is not really something

the consumer can readily infer; hence, we have a credence quality. If, on the other hand, we consider a consulting offer, e.g. legal consulting, experience and credence qualities will be highly emphasized. Whether the help that was needed has been received is something that can still be ascertained, but the investigative scope of the customer is not wide enough to determine whether the services rendered were of the highest possible quality.

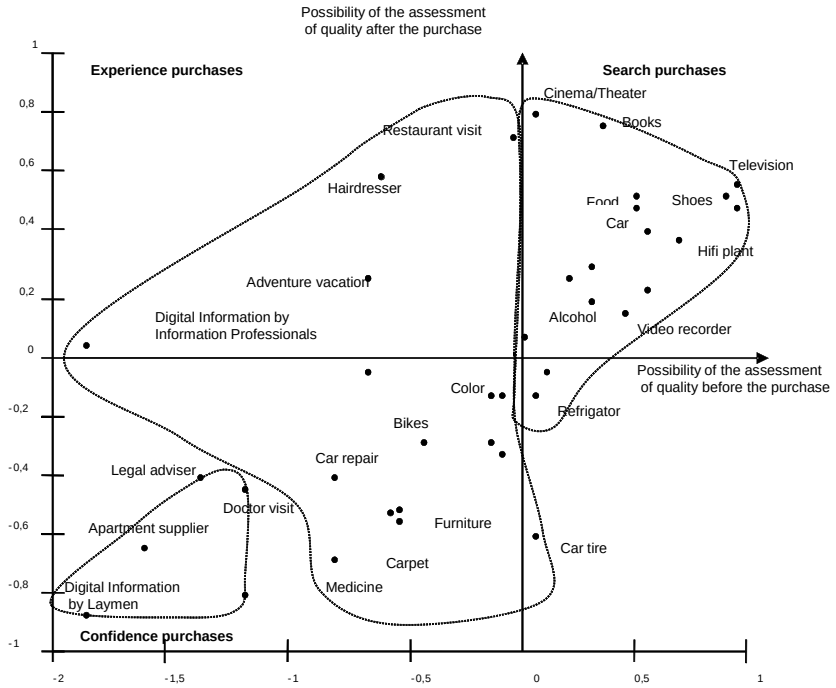

Figure 3.3: Positioning of Goods' Qualities in the Purchasing Process. Source: following Weiber/Adler 1995, 107.

Darby and Karni thus explicitly speak of credence qualities, and not of credence goods. Since goods generally unite several qualities at the same time, we will thus speak, in the following, not of search, experience and credence goods but, more precisely, of goods with search, experience and credence **qualities**. The classification according to goods is thus to be understood as a reference to the respective dominant qualities (Mengen, 1993, 130).

Generally, it can be said that the majority of material goods display search and experience qualities, whereas most services are heavy on experience and credence qualities (Zeithaml, 1981, 187). Empirical analyses show that although there are

blurry areas, we can still form product groups in which one or two of the qualities predominate (Weiber & Adler, 1995; Bayón, 1997, 19 and 55 et seq. with a detailed discussion and references to further studies).

The positioning of the information good "book" among search buys in Figure 3.3 is the result of the unilateral suspension of the information asymmetry on the part of the provider. Since he lets the buyer inspect the book, disclosing its content, the buyer can acquire the information even without purchasing the product. Hence what is actually being sold is the information carrier, its advantages including storability, reading comfort and the option for repeated usage. The same goes for music that one can listen to before buying it.

Interestingly, it depends less on the object of purchase than on the buyer himself whether experience or credence qualities dominate. In the absence of sufficient expert knowledge in the relevant area, credence qualities always dominate for the buyer of an information good (Talkenberg, 1992, 74, 172-173). If we define expert knowledge very broadly, we can also include social information (sports, royal houses etc.), which can only be assessed by "experts", in this category. Considering the example of electronic information services (technical databases, credit rating databases, library catalogs etc.), we can soon see that there are no search qualities at play, since the product cannot be inspected prior to the search. An information expert will be able to assess the quality of the result of an online research, as he will concentrate mainly on experience qualities, but an online layman has to accept the fact that, lacking expert skills, he has no option other than trust in the quality he seeks (Stock, 1995, 150 et seq.). Providers of goods with pronounced experience and, even more pertinently, credence qualities, are presented with many options for strategic behavior, as they needn't fear that decreases in their service's quality will be quickly recognized and thus lead to lower profits (Hauser, 1979, 751). For electronic information services, such as online databases, this means that low-quality products can be sold at very low risk, particularly to buyers with no expertise in the relevant subject (Stock, 1995, 153-154). However, even experts, who are able to make accurate assessments of the service they receive, must trust the provider that every detail of the service rendered is as advertised (Ernst & Giesler, 2000, 198).

> E.g. the number and precision of the interviews conducted by a market research institute cannot be controlled by the client, either before or after paying for the service. A steady presence of the client during the interviewing process is possible, in principle, but the costs would be prohibitive for him (the sheer time required). Even if the client were prepared to sacrifice his time, his presence, e.g. during the evaluation of the results via multivariate procedures would still make no sense, due to his (probable) lack of expert knowledge. As the appropriation of the necessary knowledge is, again, prohibitively expensive for the client, he must finally trust in the quality of the market research study (Mengen, 1993, 130).

In summation, we can state that information goods only display a few search qualities if they have already been produced. Generally, though, credence and–depending on the demander's knowledge–experience qualities are dominant.

3.3.4 On the Functionality of Information Markets

We will now list some examples for information markets that typically give rise to information asymmetries, in order to derive from them what the conditions are that make them function in spite of the permanent threat of market failure.

As an example for a functioning information market, let us consider the market for stock information. Information on current market rates are extremely valuable for the business of banks, brokers and financial service providers in general. Independently of whether we assume a supply of stock information in real time or with a delay, it must be assumed that this information good is subject to the information paradox. It would lose its value if it were disclosed prior to purchase. Nevertheless, trade with such information is well-developed and extremely lucrative (Ernst & Köberlein, 1994, 8). Why is that?

On the one hand, we are dealing with so-called price information. With this sort of information, quality insecurities are generally very low, because (Ernst & Köberlein, 1994):

- the form of the information is fixed precisely: as a demander, one expects a price statement with two decimal places in a particular currency. Even if the content, i.e. the actual price, is only released after the purchase, one knows beforehand exactly what the information will look like.
- the value of an information can be very easily gauged despite an ignorance of the specific content. If, for example, one must make a selling decision about a share that has been bought for €37.50, the profit or loss to be expected can quickly be calculated as being the difference to the current rate.
- the costs of the information are known in advance, even if it is generally not single pieces of stock information but an ongoing stream of information that is being sold. To wit, the permanent changes of the rates represent a regularly recurring buying impetus.
- doubts concerning the quality of the information received can quickly be removed post-purchase via comparison with other providers or the often freely available time-delayed share price information.

The case is quite similar for information offers by price agencies, whose service consists of collecting information about the price of goods, analyzing it and selling it in connection with traders' licenses. The information product they offer is practically devoid of quality insecurities, because the form of the offer is precisely outlined, its value known via the calculable price range and even the costs generated by the commission are already set prior to the purchase (Ernst et al., 1995, 72).

Generally, it can be observed that on markets for price information, which are marked by a high degree of transparency and standardization, quality insecurities are few and far between (Ernst et al., 1995, 71).

Let us now turn to some examples, where pronounced information asymmetries are in place, which would have to lead to market failure. As addressed above, we have to assume that (information) goods are always bundles of search, experience and credence qualities, of which one or two are more pronounced than the other(s). Checking for the market failure of information goods must thus be done in two steps: first, it has to be seen whether the product in question is actually an information good. In order to judge, in the second step, whether market failure is to be expected for the good in question, one must analyze its qualities. If search qualities dominate, quality insecurities due to Adverse Selection or Moral Hazard, and hence market failure, are not to be expected **prior to purchase, or completion of the contract**. If experience and credence qualities dominate, respectively, significant quality insecurities are to be expected prior to purchase. For the situation **post-purchase, or completion of the contract**, it holds that: if the information good has pronounced experience and/or credence qualities, Moral Hazard will lead to credence insecurities for follow-up buys or lasting business relationships. Existing quality insecurities can be discovered–as addressed above–either with a delay (experience qualities) or even never (credence qualities). In these cases, market failure would occur. A reminder: market failure refers to deviations of the result of marketary coordination from an ideal result derived with the help of a reference model. A viable yardstick would be a market with symmetric information, i.e. in which suppliers and demanders are equally well-informed. If the market delivers inferior results, due to one side of the market having to suffer disadvantages in the cost-benefit ratio vis-à-vis the reference model of symmetric information, market failure is at hand. Disadvantages can be exorbitant prices for any given service, or inadequate services, particularly in terms of quality, at a given price.

If we consider the (first) purchase of an information good, such as a computer software, we will find typical information asymmetries. In order to be able to gather as comprehensive an impression as possible of the quality of the offer, the buyer would have to be given the information good for free. Only in this way can he test its functionalities and check whether they satisfy his demands.

Hence if one had to buy a project management software purely on the basis of product description and price, it would be impossible to distinguish good offers from bad ones. For precisely this reason, it is common practice for software to make trial versions, restricted either in terms of available time or content, available to the customers. The providers thus make experience qualities, which can only be checked post-purchase, to search qualities that can be inspected before the transaction. However, this is only valid for the qualities that can be inspected during the trial period. For those that only transpire after a prolonged period of usage, such as stability, dealing with larger amounts of data, performance during multiple access, the quality insecurity will prevail. Furthermore, performance insecurities will arise if the software is not subject to a one-off buy, but is planned to be re-

purchased in all of its subsequent versions. Whereas it could still be stipulated during the transaction how often and at what price updates would be offered, their quality can only be trusted in. However, for all further buys of the same product from the same provider, the information asymmetries will be less severe, as the user can now assess the experience qualities much more easily due to his previous exposure to the product. A trade-off comes to pass: the customer can rate the product more quickly and accurately after follow-up buys than after first buys, but has to accept the risk of his trust being abused by the provider to deliver worse quality than expected (Moral Hazard).

Examples for other information goods are market, industry, product or competition analyses. Here we must distinguish, however, whether the analyses are yet to be conducted or whether results are already available. If we only consider the latter aspect, we need merely consider the situation prior to purchase. Without any access to the result, an information asymmetry will be at play. The demander must make his purchasing decision in the face of insecurity regarding the product's quality. To make matters more complicated, insecurity concerning the quality of production is added to the mix as a further credence quality. The buyer cannot check what level of care went into each single step of the production process. Has the survey sample size actually been reached and completely processed? How carefully have the statistical test procedures been selected? Even if some of this quality information may be documented, its closer analysis and assessment is impossible or too complex for someone without sufficient expert knowledge.

If the desired analysis has yet to be made, insecurities rise. Where an advance payment is required, great quality insecurities have to be accepted prior to signing the contract: information that could be disclosed to alleviate the buyer's doubts does not exist yet. At best, the buyer can determine a service package up front. After the contract has been signed, Moral Hazard comes into play. The customer cannot assess the actual quality of the analysis' implementation, which leads to pronounced performance insecurities.

Despite this problematic assessment, there is still a well-functioning market for such analyses. Certain mechanisms can be recognized that prevent the failure of an information market. Thus renowned companies are favored for market research contracts, as it is clear that they have already made many good analyses and have a comprehensive stock of customer references. These initial considerations already show what behaviors a company can use in order to make viable offers on an information market despite the presence of economic adversity. Such measures on the part of companies to pointedly offer quality information is called Signaling. The whole of Chapter 22 is devoted to this subject.

3.3.5 Information Asymmetries Before and After Completion of a Contract: Adverse Selection and Moral Hazard

For the question of whether information asymmetries occur before or after the signing of a contract, we can distinguish between two kinds of contracts: those that are completed as purchasing agreements according to §§ 433 et seq. of the

German Civil Code (Bürgerliches Gesetzbuch, BGB), or–and this will be of significance in the following–as contracts for services according to §§ 631 et seq. BGB, in which the provider performs a service (e.g. a survey or a Web design with animations) for a fee.

Due to the relatively unpronounced search qualities, information asymmetries **prior to the signing of a contract** give rise to the problem of Adverse Selection. Customers can only really comprehensively inform themselves about the quality of an information product if they have actually received the information (information paradox). The providers, in turn, have no interest in reducing this information asymmetry by comprehensively disclosing the information. Even if the information provider is prepared to disclose parts of the information prior to purchase, the problem still remains that the demander cannot necessarily assess the quality. Depending on his level of knowledge, he may be able to assess the experience qualities, e.g. whether information about a company's business performance is plausible. Assessing the credence qualities, however, is–as has been seen on the example of the market research study–impossible even to the expert, or at the very least connected to prohibitive costs.

From this fact springs Moral Hazard, as the provider has the option of offering lower quality without any risk of the customer easily discovering it. In information goods, Moral Hazard mainly occurs when they are entirely uninspectable prior to purchase, having yet to be produced. In a research contract, disclosing the information is impossible before the (information) work has been begun. Here the buyer even has to act entirely on the basis of credence.

Generally, inadequate search qualities lead to quality insecurity for the demander looking to buy information goods (Bayón, 1997, 19). His information activities prior to (the initial) purchase can merely serve to inform him about the search qualities. Experience and credence qualities only transpire after the purchase, via experience from using the product, or never. The negative economic consequence here is Adverse Selection, where lower-quality offers displace higher-quality ones, and a market even collapses entirely (total market failure), due to information costs that are too high or because it is impossible to inform oneself beforehand at all.

Investigations of the question of what leads a provider to offer high or low quality, see the quality as a decision variable. It is at its lowest when casual customers make one-off buys. This is the case with restaurants in tourist areas, for example (Tirole, 1995, 234). The case is different when there are well-informed customers, e.g. due to product reviews. Here it is shown that as the number of informed demanders rises, so will the probability of a positive correlation between price and quality. This is a positive external effect which spreads from the informed consumers to the uninformed ones (Tirole, 1995, 235 et seq.). The case is somewhat different if repeat purchases are made. Here the reputation of a provider (e.g. his brand image) plays a significant role. It is to be assumed that the provider will offer high quality for as long as the (discounted) quality premium he achieves on the basis of his reputation is higher than the cost savings via quality reduction would be (Tirole, 1995, 245 et seq.). Quality insecurities thus only lead to Adverse

Selection if no mechanisms are being establish on the market that give the provider reasons to offer high quality.

Information asymmetries **after the signing of a contract** bear the danger of Moral Hazard. Moral Hazard occurs in two scenarios: on the one hand, when information goods are entirely uninspectable prior to purchase, as they have yet to be produced. In a research contract, disclosing the information is impossible, after all, before the (information) work has begun. Here the buyer has to act entirely on the basis of credence. On the other hand, Moral Hazard is to be expected when it is not merely a one-off (purchasing) contract, but the demander either plans on making follow-up buys or–which is very common, particularly for information goods–enters a longer-term business relationship with the provider by having information goods (daily newspapers, magazines, stock information etc.) delivered in the context of a contract for services. The provider then has the option of lowering the quality of his service from one purchase, or delivery, to the next, as his behavior can at best be partially observed by the customer. This latter does not know about the care that went into the making of an information product, as one generally only gets to know the result. Yet Moral Hazard can also occur for pronounced experience qualities–we only have to think of the credit of trust accorded to the publisher on the part of the subscriber. He consumes his newspaper, expecting a consistent level of quality. Should the quality decrease, he would only notice after quite some time, before making the decision to cancel–which might only be possible at the end of the subscription period.

The case is similar with follow-up buys. If a demander has obtained a high-quality result from an information search, he will assume the same level of quality to result from his next commission. The provider thus at least has the opportunity of providing an inferior service.

Information asymmetries after the signing of a contract thus lead to performance insecurities and subsequently, due to Moral Hazard, to a potentially decreasing service offer if the provider decides to exploit the information asymmetry. We say "potentially", because–analogously to the example described above–these consequences only take effect if there are no mechanisms on the market that give the provider the motivation to produce high quality anyway.

Independently of whether information asymmetries occur prior to the signing of a (purchasing) contract or after the signing of a contract (for services), there are two critical factors: the **subjective** critical factor is based on the buyer's expertise. Only as an expert can he adequately assess the quality of an information good himself, be it prior to purchase or with regard to a service stipulated in the contract.

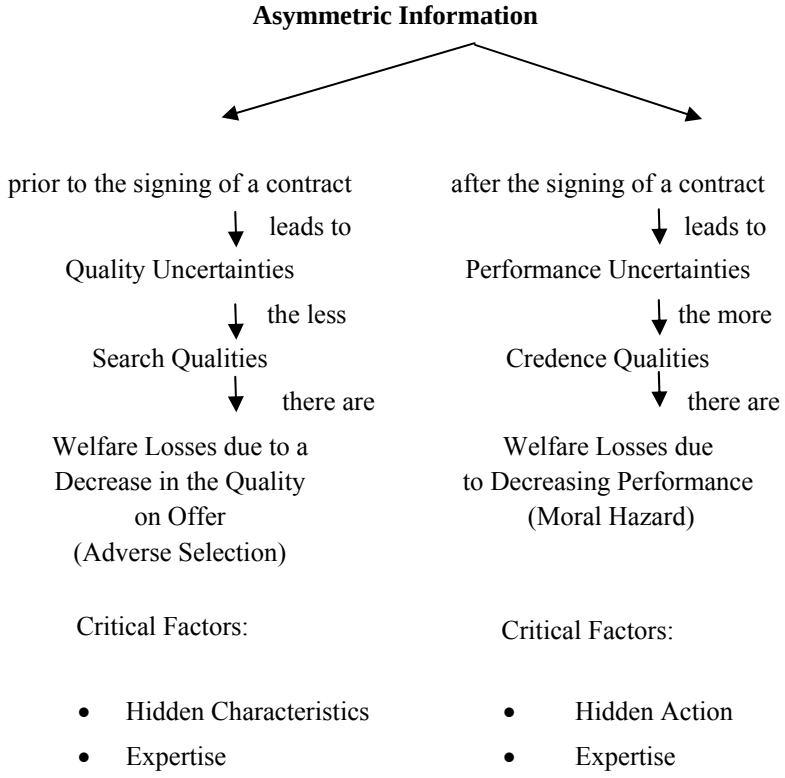

Figure 3.4: Effects of Asymmetric Information.

Objectively problematic is the lack of availability of quality information. Due to the information paradox, a full inspection of the quality of information goods is often impossible, and there remain "Hidden Characteristics" (Göbel, 2002, 101). Also, due to the contractor's services being extremely difficult to supervise ("Hidden Action", Göbel 2002, 102), it is impossible after signing a contract to adequately assess the quality of the performance process (Picot et al., 2003, 57 et seq.).

3.4 Network Effects for Information Goods

Another particularity to be investigated in information goods are the occurring network effects. To begin with a few examples: if a company considers acquiring a software that is meant to be used not only internally, but also jointly with other companies–consider if you will Electronic Data Interchange (EDI) software, for instance–it will consider very carefully whether it wants to buy a software that is also used by other companies or not. For example, if it wants to exchange order data with its customer and/or suppliers, or perform accounting operations undisturbed, it will be of great advantage if both parties use the same standard. Given the right level of prevalence, the information good "EDI software" can thus provide the user with an additional value, which stems from the total number of its users, to the value arising from the product itself (Buxmann, 2002). Economically, this is called a network effect, or network externality. Analogous effects can be observed for the different forms of content, or in the social networks of Web 2.0. Facebook and co. are the more valuable for their existing customers the more widely they are being used. It is easier to find interesting contacts and one's own contributions will reach a greater audience. Content also gains publicity when people talk about it. The positive effects of bestseller lists on sales figures bears this out. If content, e.g. films, is being talked about in a specific form, e.g. on Twitter, one can even predict, prior to the release date, how big its initial profits will be with some accuracy (Peer, 2010).

A net, or network, is, abstractly speaking, similarly to a system, an amount of objects with connections (Economides, 1996, 674; in relation to systems in general Willke, 1991, 194) or the possibility of connections between them (Flechtner, 1966, 353). An information-economic reading will define a network as a summary of the users of a certain good or compatible technologies (Dietl & Royer, 2000, 324).

If the users are physically connected, we speak of **real** networks. This is traditionally the case with fixed telephone networks, in which the individual telephone owners are durably connected with each other via the installed cables.

If the users are not physically but merely logically connected, we speak of **virtual** networks (Shapiro & Varian, 1999, 174, 183; Dietl & Royer, 2000, 324). They are virtual because the relationships between the participants are primarily potential in nature (for a more comprehensive discussion of the concept of virtuality Linde, 1997, 13 et seq.). It is not the case, as it is in real networks, that one is only a participant if one is physically connected with the others. Everyone who buys a virtual network good derives value from the fact that he has the option of establishing a connection with the other network participants. Virtual networks are, for example, all users of DVD players or video recorders, or all users of a certain operating system or gaming console.

Another, more abstract example of a virtual network are languages, e.g. the network of all Anglophone people (Friedrich, 2003, 4). Everyone who speaks this language has the option of communicating with every other English-speaker worldwide. English is not so widely used, and regarded as a world language, be-

cause it is so easy to learn, but because it is used by the majority of people as a means of communication. Everyone who wants to make himself understood internationally is thus forced to join the network, i.e. learn English. The value of this network lies in its multiple ways of communicating, and it is increased by every further "user" of the language. It would be imaginable to use another language for international communication–e.g. the artificial, very easily learnable world language Esperanto–but the adjustment costs of establishing it as a valid standard for everyone would be extremely high.

In contrast with many daily-needs consumables (e.g. food, articles of hygiene, medication) or durables such as clothes or furniture, which are traditionally used very individually or by a very restricted number of people, network goods provide value not only through their features (basic value, original value), but further provide each individual consumer an additional value that goes beyond, via the total number of other users, the Network Effect Value (Buxmann, 2002, 443), also called derivative value. The more users, the greater this Network Effect Value will be for the individual. This will be immediately understandable for a real network, if we imagine the value of a telephone network with only three participants as opposed to a network with connections worldwide. But in a virtual network, too, the advantages are obvious, because one can use the same word processing application to effortlessly exchange data with others, or discuss the software's functionalities. For network goods, the value derived from their prevalence is dominant vis-à-vis the value that stems purely from the good's qualities.

According to Weiber (1992, 15 et seq.), network effect or network goods distinguish themselves from singular goods, the value of which stems purely from the product itself (e.g. fuel), and system goods, whose value can only properly unfold when there are sufficient options for interaction with others. Video telephones, fax machines, e-mail applications etc. are examples for such system goods with no basic value. They absolutely require the existence of at least a second user.

	Positive	**Negative**
Production	• Usage of unpatented inventions via third parties • Investment in human capital	• Environmental pollution • Noise pollution of the residents
Consumption	• Education • Restoration of a historical building	• Exhaust fumes • Barbecue evening • Dogs barking • Excess Consumption of Alcohol

Figure 3.5: Positive and Negative Externalities in Production and Consumption.

External effects (externalities) are present whenever economic activities (buying and selling decisions by economic agents) affect the welfare of uninvolved third parties, and nobody is remunerated/compensated for it (Mankiw et al., 2008, 229). External effects can occur during production as well as consumption, and be of a beneficent (positive) or maleficent (negative) nature. Generally, they lead to the private and social costs/values of economic activities to come apart.

In negative external effects, the social costs outweigh the private. If a company settles on a production method that is very noise-intensive, residents will suffer without being compensated for it. The consumer, who is smoking his cigarette produces smoke, affects his environment but does not face punishment. The private value of smoking outweighs the social. In both cases, the social (additional) costs and (reduced) values play no decision-making role, respectively. From a social point of view we have market failure, as it would be better if companies and individuals produced less noise and smoke, respectively, for others to bear without recompense.

The opposite is the case for positive external effects. If companies invest in their employees, making them more versatile and thus, generally, more attractive for the labor market, the companies' private costs will be higher than their social costs. The case is analogous for a private individual investing in his or her education–here the social value, i.e. more opportunities on the labor market, outweighs the individual one. From a societal perspective, it would be better if companies and individuals invested more in education. Where externalities, both positive and negative, occur, market failure will habitually follow. The socially desirable supply and demand figures do not match the amounts privately supplied and demanded, respectively (Mankiw et al., 2008, 229 et seq.).

3.4.1 Direct Network Effects

Network goods also give rise to consumer externalities: so-called network externalities. These, too, are external effects. They occur because–abstractly speaking–networks provide values via the interlinking of their elements. The number of elements linked in a network thus influences the total value. A new network participant increases the value of the pre-existing ones, and simultaneously makes the network more interesting overall for further participants. Network effects are also called "Increasing Returns to Adoption" (Arthur, 1989, 2004) or "Demand Side Economies of Scale" (Farrell and Saloner, 1986). Also regarded as network effects are the so-called Information Economies of Scale (Habermeier, 1989), which occur when the quality of a good can better be assessed due to its prevalence.

Direct network effects can be described a little more formally in the following way: the value U derived by an individual i from a network good (U_i) depends not only on the (technical) characteristics E but also on the number of individuals Z who also use the same good (Blankart & Knieps, 1994, 451 et seq.). To wit:

$$Ui = Ui\,(Z, E) \text{ with } Ui\,(Z, E) < Ui\,(Z^*, E) \text{ for } Z < Z^*$$

Two network goods with the same characteristics (E) thus provide different values if they have different amounts of participants (Z). The good with the greater number of participants provides the greater value. Put even a little more generally, we can say that the greater the number of a network good's participants, the greater its value for all, both those that are new to the network as well as those who are already members. The more users join a telephone network or buy and use a spreadsheet application software, the greater the value for the existing users. Conversely, the more existing users there are, the greater the value for newcomers will be. Economically speaking, the new users generate positive network externalities for all those who are already a part of the network. If these increased benefits are free of charge, or at the very least extremely cheap, positive network externalities are at play (Steyer, 1997, 206). An example of compensation would be if each new network participant was remunerated by the existing and/or the yet-to-come participants for the increased benefit he caused.

These positive externalities only occur for as long as the network is not crowded, however. If we imagine a cell phone network, for instance, too many registered participants can also cause negative network externalities. Hang-ups or longer waiting periods before registration in the network caused by new participants cause additional costs for the existing customers. At the same time, the entire network becomes less attractive for new customers. Thus–and again, with no (financial) compensation–negative external effects are at play (Liebowitz & Margolis, undated).

Network externalities thus represent a special for an consequence externality, in which the value, marketarily uncompensated, which a person derives form a good depends on how large the **number** of the good's other consumers is (Varian, 2007, 782 et seq.). The occurrence of positive externalities in real network goods has been known for a long time (Rohlfs, 1974), and is largely regarded as a given (Liebowitz & Margolis, undated). But negative external effects in real networks–called congestion costs–have also been observed for some time (Blankart & Knieps, 1994, 452; MacKie-Mason & Varian,1994a, 84 et seq.).

Positive external effects in virtual networks have only become the focus of research at a later date, but they too can be found here (Blankart & Knieps, 1992, 78). If we first regard **software**, we can, for example, make out positive externalities due to decreasing coordination costs. They decrease when a standard is being used. If the same standards are being used, this will make the exchange of data between the single network participants significantly easier. This may be a reason for the dominance of the "Wintel" standard for PCs. This acronym is made up of the operating system **Win**dows and the frequently used chips by In**tel**. Around 90% of the PC market is based on the Wintel standard, which builds on the architecture of the PC as introduced by IBM in the early 1980s. This is why there is often talk of IBM-compatible PCs (Ehrhardt, 2001, 26). Such a standard increases the value for the network participants, respectively lowers the costs connected to network growth, leading to lower data exchange costs or user training, for example (Steyer, 1997, 207). When user numbers are high, software errors will be found more quickly and the number of expert users of a software rises, so that

companies who use a prevalent technology will find qualified employees more easily. Such non-marketary services result from the learning effects brought about by the prevalence of a software. The greater the number of users, the more comprehensive the exchange of knowledge and thus the learning effects with regard to the application and troubleshooting (Xie & Sirbu, 1995; Cowan, 1992).

Virtual (software) networks can also give rise to negative externalities, however. Negative network externalities, which have the character of a "congestion", as more and more people clog the network, have so far been given short shrift, though. Among the few exceptions are the analyses of MacKie-Mason & Varian (1994b) as well as Westland (1992). For the users, such phenomena can be experienced as unavailable websites, for example.

Now what is the situation for **content**? Are there direct network effects here, too? An unequivocal confirmation is provided by media economics, which very generally assumes that network effects apply to media (Gerpott, 2006, 332 with many further references; Hutter, 2003, 266 et seq, explicitly for music Haller, 2005, 226). They occur when content of an informative or entertaining character becomes the object of social communication. If people can exchange views on songs, political news or sports results, the contents have a conversation value (Blind, 1997, 156) or a "Synchronization Value" (Liebowitz & Margolis, undated), which springs from the interaction with others. These positive social network effects occur when content (Gerpott, 2006, 332)

- is rated more positively [by economic agents], or demanded more intensively, the greater the number of other people is with whom they can (or could) exchange views on these contents, because social communication, or conversation with like-minded people, thus facilitated is regarded as satisfying (e.g. during a soccer World Cup),
- is demanded [by economic agents] because they want to be able, due to the large number of other people who have (presumably) already taken note of these contents, to eventually develop their own stance ("have a say") on these facts and circumstances (e.g. in the case of bestselling books, such as the Harry Potter series).

These two facets of network effects are often described as Total Effect and Marginal Effect (e.g. Farrell & Klemperer, 2008, 2007). For the former, the value is increased because the existing network participants profit from the inclusion of another user:

> One agent's adoption of a good benefits other adopters of the good (Farrell & Klemperer, 2008, 2007).

The latter describes the growing impetus for a potential participant to join the network, the bigger it already is:

> One agent's adoption […] increases other's incentives to adopt it (Farrell & Klemperer, 2008, 2007).

The Marginal Network Effect thus displays a certain similarity to the bandwagon effect long known in economics (fundamentally Leibenstein, 1950). In the bandwagon effect, demand for a good is increased due to its being consumed by others. The psychological basis of this behavior is regarded as the desire to ape the behavior of a peer group. This effect may be–slightly differently to the social-communicative network effects described above–a more psychologically motivated need for conformity (Stobbe, 1991, 141 et seq.), but it has the same effect on the prevalence of a good.

Content offers can–and this is often neglected–also be subject to negative effects, however, in which case they are

> rated more negatively […] The greater the number of other persons who already know the content, as a decreasing degree of exclusivity (and the correlative up-to-dateness or novelty reduction, respectively) of the content will lower its subjective value for the single recipient (for example in stock analysts' recommendations to buy/sell) (Gerpott, 2006, 333).

One of the few studies of negative network effects is by Asvanund et al. (2002). They determine, empirically, that in P2P networks

> additional users contribute value in terms of additional network content at a diminishing rate, while they impose costs in terms of congestion on shared resources at an increasing rate.

This example relates a combination of decreasing positive network effects as concerns additional content and negative ones to the emerging scarcity of resources.

Within the direct network effects we just discussed, we can additionally distinguish local and global effects (Sundararajan, 2005). **Global network effects** apply to all participants of a network, **local network effects** occur in "neighborhoods", e.g. Instant Messaging.

> A typical user of communication software like AOL's Instant Messenger (IM) is generally interested communicating with a very small fraction of the potential set of users of the product (his or her friends and family, colleagues, or more generally, members of an immediate 'social network'). This user benefits when more members of their immediate social network adopt IM; they get no direct benefits from the adoption

> of IM by other users who they have no desire to communicate with (Sundararajan, 2005, 1).

The increased benefit depends not on the total number of participants in such cases, but on the number of participants in one's personal environment. Such an environment is no longer to be regarded as necessarily geographically determined these days, according to Van Alstyne and Brynjolfsson (2004), since the modern communication channels give rise to communities that generate local network effects location-independently. As opposed to their global counterparts, such local network effects can facilitate diversification due to smaller networks with a larger number of participants from one's personal environment providing greater value than larger networks that have participants who are, socially speaking, further away (Jonard & Yildizoglu, 1998).

3.4.2 Indirect Network Effects

The direct network effects described above always deal with the immediate reciprocal advantages or disadvantages occasioned by an increasing number of users. Apart from these, though, there are also indirect network effects. They describe an increase in a network good's attractiveness due to increased benefits that result not from direct communication, i.e. that are only mediate. Often called indirect network externalities, they mainly refer to the range of offers complementing a network good (Katz & Shapiro, 1985). Indirect network effects thus deal with relationships to the opposite side of the market, whereas direct network effects regard interaction with one's own side of the market, i.e. one's peers (Farrell & Klemperer, 2008, 1974).

In real as in virtual networks, indirect network effects consist of additional offers of complementary products and services. In a real network good, such as a telephone, these can be the different end devices, accessories and information services. In virtual network goods, the primary good–such as an operating system–gives rise to further complementary application (text processing, spreadsheet) and service programs (virus scanners, tuning software). The greater the network, the more complementary offers are to be expected on the market (Economides, 1996, 678 et seq.). A network good's attractiveness, in turn, increases in proportion to the comprehensiveness and variety of the complementary offer of products and services.

Katz and Shapiro here speak of a "Hardware-Software" paradigm (Katz & Shapiro, 1985, 424), which, broadly defined, can be applied to many other goods. If someone plans to buy a PC, it is of no small importance for the individual how many other people have decided to buy a similar hardware, as the number of units sold directly influences the variety of the range of software on offer. In credit card networks, the card would be the hardware and its acceptance by retailers the software. The same goes for durables (hardware) and their complementary repair services (software), or video/DVD players (hardware) and the corresponding films

(software), or gaming consoles and their games. Often, there are entire packages of complementary and intra-compatible goods (e.g. operating system, hardware and application software) that are in a utilization context and are factored in during the purchasing decision. In that case, it is not only the individual products which are in competition with each other, but entire systems of goods (Stelzer, 2000, 838; Heindl, 2004, 112 et seq. with further references). Common to all examples is that apart from the primary (basic) product, complementary products and services are of vital consequence for the generation of customer value.

Apart from the aforementioned additional products, complementary services can also be purchasable services such as hotlines or other forms of after sale support. However, in a growing network non-marketary services are increasingly available. Support from other users can be had via Frequently Asked Questions (FAQ) or in newsgroups.

Just like **software**, which requires appropriate complementary products in order to be used, digital **content** can also only be used when the necessary technical complements are available. For example, the more users of online music offers there are, the more providers will bring playback devices such as the iPod onto the market or integrate playback tools into other products, like cell phones or handhelds. For every topic that has a conversation value, i.e. that is subject to direct network effects, electronic communication complements can turn up at any time. The incalculable amount of newsgroups, message boards, blogs, wikis etc. attests the existence of such complements. For physical content, indirect network effects always occur when the electronic or physical complements mentioned just now are available. A physical complement could be a dictionary or a thesaurus, used to complement one's reading of a book. What can also be observed is that the release of a film, for instance, is frequently accompanied by the market launch of related music, books, games or other merchandising products such as mugs or T-shirts. In the case of music, complementary (digital) products are increasingly being created apart from the original song, e.g. ringtones or screensavers. Here we are dealing not with (indirect) network effects as such, though, because no associated form of usage is being created. One first consumes the film and then, possibly, reads the book or listens to the soundtrack. Even if the goods are consumed multiple times, this is done neither simultaneously nor in a direct qualitative relation: in other words, there is no "Hardware-Software" relationship in the precise meaning of the term. Still, it can be observed that film or music hits engender a large palette of merchandising products, the distribution of which is often highly lucrative for the provider (Kiani-Kress & Steinkirchner, 2007, 68). Their sales are boosted by a large network and strong direct network effects. However, a strong distribution of these thematically aligned goods, conversely, positively affects the network of those who have already seen a film or heard a piece of music. Insofar, merchandising offers can be labeled **quasi-complements**.

In our previous representations of indirect network effects, we have not cleanly distinguished between effects and externalities; we will catch up on this now. The aforementioned indirect **network externalities** represent reciprocal influencings, which are partly depicted as prices. When the prices of the complementary prod-

ucts decrease due to an increased demand of the primary product, so-called pecuniary (monetary) external effects are at play. In such cases, market failure is rather improbable. The case is different for the variety of offers as an indirect network effect. Here externalities may well arise, i.e. increased benefits for network participants that are not compensated marketarily. Existing network participants, e.g. Mac users, profit more from additional hardware buyers than the latter do, as each additional buyer increases the impetus on the part of the software industry to provide a more comprehensive offer of applications. The new buyer is not remunerated for the value he provides the existing customers (Church et al., 2002).

Since indirect network externalities are thus not always real externalities, it seems appropriate to speak not of indirect network externalities but, more precisely, of indirect network effects (Gröhn, 1999, 28 et seq., Katz & Shapiro, 1994, particularly 112; Liebowitz & Margolis, undated).

Kind of: Network Effect / Information Good	Direct Network Effects (Interaction Effects) (always network externalities)	Indirect Network Effects (Complementary Offer) (partially network externalities)
Software	• Positive: Data transfer, cooperation, troubleshooting • Possibly negative: Congestion	• Positive: e.g. hardware, additional programs • Possibly negative: viruses, spyware etc.
Content	• Positive: Communication advantages (having common topics of conversation, being able "to have one's say") • Negative: undesirable distribution of exclusive information	• Positive: e.g. end devices, complementary content online, quasi-complements • Negative: e.g. advertising, fraudulent websites

Figure 3.6: Positive and Negative Network Effects for Information Goods.

Indirect network effects are of an overwhelmingly positive nature, because they reinforce the basic product's value. However, they can also be negative. This is the case if the complementary offers provide no value but harm instead. Very large networks often have a downside, e.g. operating systems (MS Windows) or browsers (MS Internet Explorer) are heavily susceptible to attacks via viruses, spyware etc. The costs resulting for the user, for security measures and possibly the rebooting of their systems, must be shouldered by themselves, there is no marketary compensation.

To summarize for network effects: if direct network effects occur, they will always are (positive or negative) network externalities. When it comes to indirect network effects, on the other hand, externalities will only be a part of them, specifically when there is no monetary compensation for the additionally generated value or damage.

There is by now a whole series of empirical studies on the occurrence of network effects. Linde (2008, 54 et seq.) introduces some of them–separated into direct and indirect network effects–in detail. In a broadly conceived analysis of magazines, Clement & Schollmeyer (2009) investigate many empirical studies that deal explicitly with the measuring of network effects. The studies mentioned prove the existence of network effects in the areas of audio/video, Elctronic Payment Systems, IT, communication and gaming consoles.

3.4.3 Two-Sided Network Effects

More recent analyses of network effects show that there is not always–as had previously been suggested–a firm "primary" basic good. Considering once more the traditional complementary goods, it is pretty obvious, for one, in which order the consumer buys: first the car and then the gas, first the razor and then the blades. On the other hand, primary and complementary goods are habitually used in direct connection: the motorist fuels and drives, the bearded man takes up razor and blade.

For complementary network goods, the case is slightly different: depending on one's vantage point, network goods can reciprocally act as complements for each other. Thus in general, the usage of a good by a circle of users can increase the value of a complementary product for another circle of users and vice versa.

> Network effects can also be two-sided: increases in usage by one set of users increases the value of a complementary product to another distinct set of users, and vice versa (Sundararajan, 2006).

If we regard the users of operating systems (e.g. Windows, Macintosh, Pal OS) as a network and the software developers as another, we will soon recognize that the user of an operating system profits from additional software developers who bring new (compatible) programs onto the market. The developer in turn profits from new users, who boost the sales of his programs. Which is the basic good and which the complement here depends on the perspective one takes.

Goods for which such two-sided (indirect) network effects occur are also called **platforms** (Armstrong, 2004; Rochet & Tirole, 2003). Some examples for this are gaming consoles (console users and game developers), browsers (users and web servers), portals (users and advertisers) (Rochet & Tirole, 2003; Evans, 2003). Platform products can only be successful on the market if both participating networks develop momentum. Thus Rochet and Tirole (2003, 991) report of a scientific journal, the *Bell Journal of Economics* which had been distributed to interested readers for free during its first years of publication in order to let the networks of readers and authors grow as quickly as possible.

In many cases, indirect network effects, as we discussed in the previous section, thus only represent a fraction of two-sided network effects.

> In many cases, one may think of indirect network effects as a one-directional version of two-sided network effects (Sundararajan, 2006).

So far, there are only a few empirical analyses, most of them with a rather narrow focus (e.g. Evans, 2003). More broadly defined studies are lacking as of yet (Roson, 2005, 156).

In summation, we can say that network effects are omnipresent in the context of information goods. However, it is also notable that they are not always of equal intensity (Jing, 2000, 3). A very specific textbook will create fewer communicative effects than a new Harry Potter novel. With software, too, there are gradual differences, which can also be confirmed empirically: standard business software emphasizes the basic value for the users over the network effect value, other than is the case with standard office of data exchange software (Buxmann, 2002).

3.5 Information as Public Good

Besides the differentiation into free and scarce goods made above, another distinction common in economics is of significance here, namely the one between public and private goods (e.g. Mankiw et al., 2008, 253 et seq.). **Private goods** we call goods whose ownership rights are allocated to one owner exclusively. We need only think of food, for example, such as a (legally acquired) piece of bread, the consumption of which its owner can be denied by no-one, and the value derived from its consumption belongs to that person alone. Abstractly speaking, we are talking about the principles of excludability (the bread belongs to oneself) and the rivalry of using goods (if one eats the bread oneself, nobody else can eat it). **Public goods**, on the other hand, are goods for which none of these two principles are applicable. We will investigate this in the following.

In the first case, **excludability**, the question is whether others can be excluded from the usage of a good if they are not willing to pay for it. Let us consider, as an example for a public good, the lighting of public streets (Varian, 1998). Here it would be–albeit only with a considerable technological effort–possible to enforce the exclusion of non-paying persons, e.g. by only using infrared light, and only providing those who have paid for it with (only individually usable) infrared goggles. All non-payers would be deprived of the service and have to grope in the dark. This example, as many others, shows that an exclusion could very well be enforced technologically. Generally though, such measures are undesirable, be it for social reasons, because an equal right to lighted streets is regarded as a value for all citizens, or for purely economic reasons, as the costs of changing the lamps and the administration costs are regarded as too high.

Principle of Exclusion	Rivalry Principle: Yes	Rivalry Principle: No
Yes	**Private Goods** • Food • Clothes	**Natural Monopolies** • Private security services • Toll streets
No	**Societal Common Goods** • Fish in the sea • Environment	**Public Goods** • National defence • Public streets

Figure 3.7: Consumer Rivalry and the Principle of Exclusion for Goods. Source: following Mankiw et al., 2008, 255.

The second case, the **principle of rivalry**, concerns the question of whether a good's valuation depends upon exclusive usage, i.e. if there is consumer rivalry or if others can use the good without restricting its value for an individual user. A piece of meat can–as long as it is not shared–only be eaten by its owner; in that case, there is consumer rivalry. On the other hand, there is the value from the legal system or inner security, where each citizen derives the same advantage from using the good, independently in principle of the number of other users. If we combine both dimensions in a matrix, we get the four cases in Figure 3.7.

If both principles apply, the good is private, if they both do not apply, it is public. If only one of the principles–either the exclusion or the rivalry principle–is applicable, we are dealing with so-called mixed goods (Mankiw et al., 2008, 254 et seq., Musgrave et al., 1994, 71 et seq.). If, for example, resources are scarce but nobody can be excluded from their usage, we speak of **societal resources**. These are subject to the danger of exploitation. The single user's interest is directed toward as extensive a utilization as possible, as he does not need to pay directly for it. There is no owner who sells the good for a price. In sum, this regularly needs to overuse of the resources, as can be clearly seen in the fishing disputes and the increasing environmental pollution. In the reverse case, the **natural monopolies**, users can be excluded, but there is no consumer rivalry. As long as the provider's capacities are not exhausted, the single users will not impede each other. One more house to be protected by a private security service does not represent a significant decrease of the other contractors' protection. At the same time, it is possible for the provider to exclude some demanders, by not accepting new contracts or canceling existing ones.

Where can we place information goods, then? Are they–as is frequently contested (e.g. Kiefer, 2005, 149 et seq., Beck, 2002, 6 et seq., Klodt, 2001b, 84; Ku-

lenkampff, 2000, 69)–always public goods? In order to answer this question, we have to consult the two principles of exclusion and (consumer) rivalry introduced above.

As regards the **exclusion** of potential customers of an information good, both cases apply–that the exclusion of consumers not willing to pay is possible, and that it is not. The following examples bear this out: if an information is the exclusive property of an economic agent (e.g. an invention in the mind of a scientist), or if it is subject to legal protection, others can very well be excluded from using it legally. Illegally, there is of course still the possibility of information being transmitted, perhaps for a price. In cases where moral and ethical tenets do not form a sufficient basis for securing the principle of exclusion ex ante, it will have to be enforced ex post, after it reaches public consciousness. A particularly radical enforcement of the principle of exclusion is found in the transmission of information relevant to capital markets. It is generally prohibited by the laws regulating financial markets in Germany. In order to secure shareholders' trust in functioning capital markets, it is forbidden to exploit precise, not publicly known information about the emitter, which is of considerable importance for the price of commercial papers, particularly shares ("insider information"), for one's own benefit, transmit it to third parties or use it as the basis of recommendations (Gabler, 2010b). Another form of legal protection applies to patents. Patent-protected knowledge may only be used with the consent of the right holder. In return, the patent's content is made publicly accessible. The principle of exclusion may also be used if the distribution of information is coupled to a private good, as the transmission medium, for which the provider can charge prices.

> The rôle of the information carrier is to transform pure information into an excludable good via coding (Pethig, 1983, 386).

Information, such as the ones that are transmitted via Pay-TV, can only be received in one's household if one owns a decoder and has paid the applicable fees.

For information that is not protected legally or via a medium, the principle of exclusion can only be applied by keeping the information secret. A corporate or trade secret is, for example, a

> not apparently operational procedure, which the proprietor is interested in keeping secret, and which is based on an economic interest worthy of being protected. Confidentiality may apply to technical services not protected under separate rights (construction drawings, calculation sheets, contract documents etc.). They are not conspicuous if kept to a limited and secretive (perhaps even sworn to secrecy) group of people, and if they can be determined only by an expert after arduous study (Gabler, 2010c).

The danger here is still that information can be distributed unwantedly: this goes for information that was first revealed to a small circle (e.g. knowledge of a new research result in the research department), but particularly for such information that are made public (e.g. in the company newspaper, or even as a professional publication via open access; cf. e.g. www.doaj.org). In such cases, its further use can only be controlled incompletely at best. For the codified transmission of information on data carriers (e.g. the reprint of an article, or the copy of a CD), a control may still be possible. However, the mouth-to-mouth spreading of information cannot be prevented.

In this context, it makes sense to distinguish two phases which an information good passes through: production and distribution (Hopf, 1983, 81 et seq.). In the **production** phase, an information good initially remains the exclusive property of an individual, or of a specific group of people, e.g. the team of researchers. In this phase, accordingly, information goods are always private goods for as long as it is either perfectly secured that uncontrolled transmission is impossible or when secure property rights are in place, in the form of patents or licences, by means of which the usage of information can be made dependent upon payment–albeit if, frequently, only with great effort (Hopf, 1983, 81). However, both of these are only seeming certainties–as soon as knowledge is shared by a number of individuals, the principle of exclusion can no longer be safely enforced. If internals from companies leak to the outside, this point stands. A company cannot make the processing of such information contingent upon payment of a fee. The same goes for legal protection, which is not really able to prevent unauthorized usage and frequently cannot even be fully restored retroactively. The multitude of infringement suits filed by companies, and which lead to no clear result, prove this further.

In the phase of (marketary) **distribution**, an information good is always accessible to a multitude of users. The rights holder must expect that the information good will be distributed via illegal channels, resulting in no payments being made.

In using the **principle of exclusion** as a characteristic of the classification of products, a problem arises for information goods, as the principle holds that the usage of goods by one person takes the possibility of its usage away from others (Mankiw et al., 2008, 254). Since information goods–other than physical goods–can be passed on and copied at leisure, though, and–at least electronically–be consumed by an open number of individuals at the same time, no consumer rivalry in the traditional sense applies:

> The usage of information does not wear the product out or use it up, but the information keeps being available to other users, unchanged in scope and quality (Klodt, 2001b, 84).

The entire left-hand side of the matrix in Figure 3.7 would thus be blanked out, since information goods could then, per definitionem, have neither the status of private goods nor that of societal resources. It would be more appropriate for the characterization of information goods to focus on changes experienced by the

group of users (of software), or the group of initiates (of content) as a consequence of the respective information good's distribution. As a suitable distinguishing characteristic, we suggest concentrating not on the principle of exclusion, but instead on the emerging **network effects**. They can be positive if the existing network becomes more valuable as it grows larger, i.e. if its participants are increasingly better off. This is the case, for example, if one is able to communicate with a growing number of people about certain events, or in a certain language. The network effects can also be negative, though, if the growth represents a disadvantage for the participants. The unwanted transmission of a private or business secret is a suitable example. If we adjust the goods matrix accordingly, we will find the following four variants:

Principle of Exclusion	Network Effects: Negative	Network Effects: Positive
Yes	**Private Information** • Secret • Inventor's product idea • Insider information (ideal)	**Market Information** • TV show via Pay-TV • Film in the cinema
No	**System Information** • Stock advice • Insider information (real)	**Public Information** • Radio transmission • Free internet publication

Figure 3.8: Network Effects and the Principle of Exclusion for Information Goods.

For **private information**, others can be excluded from usage by not being allowed to share it, or via effective legal protection. If information is available to a certain group of people (e.g. company employees or subscribers of a stock market journal), and if that group would be at a disadvantage if the information were to be distributed further, we speak of **system information**. Information whose acquisition can be made contingent upon payment of a fee is called **market information**. If, on the other hand, the distribution is free and unfettered, it is **public information**.

In summary, we can say that information goods can be private goods only in their production phase, and even then only if they can either be kept secret or enjoy effective legal protection. If we take into account that even private information goods that are legally protected can only be partly protected from unlawful usage, we can see that information goods are not public goods per se, but display a clear tendency over the course of their distribution to become public goods via an intermediary mixed-good stage (Hopf, 1983, 87).

3.6 Interdependence of Economic Particularities

Information goods thus display four economic particularities that can lead to potential market failure. We introduced these particularities individually in the preceding sections, and it has become clear each time that they noticeably tighten the conditions for a successful market offer on the part of information providers. But this is not the end of it, as these four particularities additionally interact with each other. They thus become elements of a system with relations between each other. For this reason, we will refer to them as mechanisms from now on. How do those four mechanisms work together? This can be made quite clear via the example of four smaller cycles.

When a network is built, and it reaches a growing number of participants, direct network effects will occur from a certain point on. These positive interaction effects cause the occurrence of a network effect value for a network good apart from its basic value. If the number of participants reaches the so-called critical mass (Rohlfs, 1974, 29; Linde, 2008, 125 et seq.), the network effect value will be so strong from that point on that further participants join the network on the sole basis of the existing, or expected, network size (positive feedback). The growing installed base in turn leads to the providers of complements developing an increased interest in producing attractive offers for the network. At the moment, this can be observed for the proliferation of iPhone apps, which grow at breakneck speed. Other providers, like Palm/HP or Nokia, have difficulties building a similar offer. An attractive complementary offer reinforces the cycle, as it draws ever more participants. Chapter 20 of this book will discuss these aspects.

The installed base, i.e. the number of users of a product or a technology, here represents the key variable connecting the mechanisms. The provider experiences a pronounced cost degression as the result of economies of scale, scope and experience (Linde, 2008, 120 et seq.). This improves their cost position vis-à-vis slower-growing competitors and opens up latitudes for lowering prices, which in turn makes it easier for them to increase their market share.

Quality information about a widely prevalent product is easily available. They are found on the web, in testing journals or, increasingly, first-hand from one's social circle. Information asymmetries are thus reduced more quickly and also benefit the increase of one's customer base.

The last of the four mechanisms refers to the tendency of information goods to become public goods, i.e. goods that have (positive) network effects and from the usage of which third parties cannot be effectively excluded. Illegal distribution paths may establish themselves next to the legal distribution. This may have a negative effect on sales, but definitely favors the establishment of a standard, and thus complete market domination. For more on this subject, see Chapter 19 of this book.

Information providers thus face some tough challenges. What kinds of information goods they apply to, how one analyzes one's industry accordingly and how to meet them strategically will be among the questions addressed throughout this book.

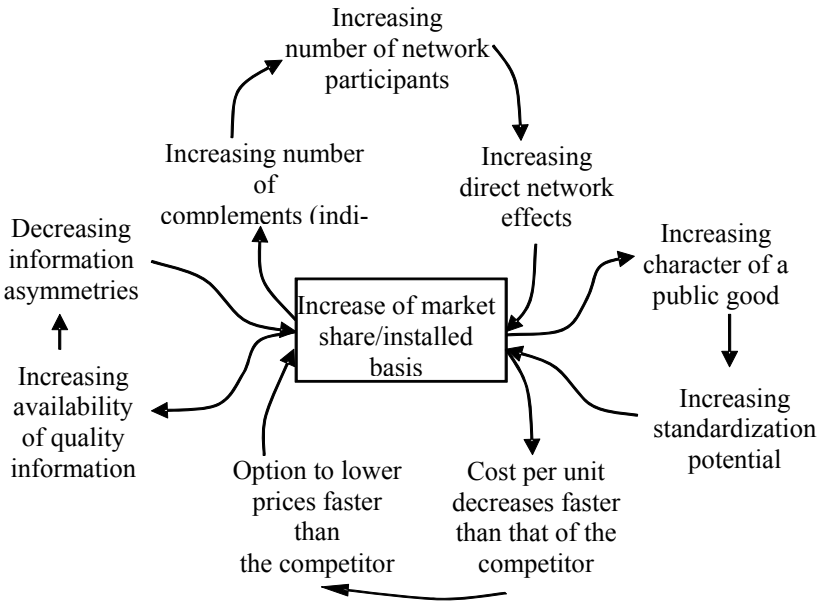

Figure 3.9: Interaction Mechanisms for Information Goods.

3.7 Conclusion

Only available in the printed version.

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