Adoption of Communication Products and the Individual Critical Mass

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THE ECONOMICS OF COMMUNICATION PRODUCTS

Communication products are characterized by the fact that the benefit that results from their use is mainly dependent on the number of users of the product, the so-called installed base, and only dependent to a minor degree on the actual product characteristics. The utility of a videoconferencing system, for example, is quite small at the product launch because only a few users are present with whom adopters can communicate. Only the increase in the number of users leads to an enhancement of the utility for each user.

The additional benefit that emerges from an increase in the installed base can be ascribed to network effects. A change in the installed base can affect the utility of products directly as well as indirectly. Direct network effects occur if the utility of a product directly depends on the number of other users of the same or a compatible product (for example, e-mail, fax machines, videoconferencing systems). Indirect network effects, on the other hand, result only indirectly from an increasing number of users because they are caused by the interdependence between the offer and demand of network products, as is the case with CD and DVD players (Katz & Shapiro, 1985). Therefore, direct network effects can be rated as demand-side network effects, while indirect network effects can be classified as supply-side network effects (Lim, Choi, & Park, 2003). For this reason, direct and indirect network effects cause different economic implications (Clements, 2004). As direct network effects predominantly appear in connection with communication products, the following observations concentrate exclusively on direct network effects.

Due to direct network effects, the diffusion of communication products is characterized by a criti-cal mass, which "occurs at the point at which enough individuals in a system have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining" (Rogers, 2003, p. 343). Besides this market-based critical mass, there is also a critical mass at the individual level. This individual critical mass signifies the threshold of the installed base that has to be exceeded before an individual is willing to adopt a communication product (Goldenberg, Libai, & Muller, 2004).

Network effects cause a mutual dependence between the installed base and the individual willingness to adopt a communication product. This again results in the so-called start-up problem of communication products (Markus, 1987): If merely a minor installed base exists, a communication product is sufficiently attractive only for a small number of individuals who are then willing to adopt the product. However, the installed base will not increase if the communication product does not generate a sufficient utility for the potential adopters. Thus, the possibility of the failure of product diffusion is especially present at the launch of a communication product; this is due to the naturally low diffusion rate at this particular point of time and the small attractiveness resulting from this.

Therefore, the supplier of a communication product must have the aim of reaching a sufficient number of users who then continue using the product and motivate other individuals to become users, thus causing the diffusion to become self-sustaining. In this context, the management of compatibility (Ehrhardt, 2004), the timing of market entry (Srinivasan, Lilien, & Rangaswamy, 2004), penetration pricing (Lee & O'Connor, 2003), the giving away of the communication product (Shapiro & Varian, 1999), and price discrimination, which is based on the individual's social ties (Shi, 2003), are frequently discussed marketing measures. In order to market

communication products, though, it is first of all necessary to gain knowledge about the characteristics of network effects and their influence on the adoption of communication products. Afterwards, the corresponding marketing measures can be derived.

CHARACTERISTICS OF NETWORK EFFECTS

Generally, two dimensions of the emergence of direct network effects are distinguished (Shy, 2001). On the one hand, network effects arise in the framework of active communication, that is, when contacting an individual in order to communicate with him or her. On the other hand, network effects also result from the possibility of being contacted by other individuals (passive communication). As direct network effects therefore result from the possibility of interacting with other users, they do not automatically arise from the purchase of a product, but rather from its use.

Regarding the functional correlation between network effects and the installed base, the literature especially distinguishes the four functional types presented in Figure 1 (Swann, 2002). While the linear function (Figure 1a) stands for the assumption that regardless of the point of time of the adoption, each new adopter causes network effects to the same degree, the convex function (Figure 1b) represents the assumption that each later adopter causes higher additional network effects than earlier adopters. Those two types of functions commonly represe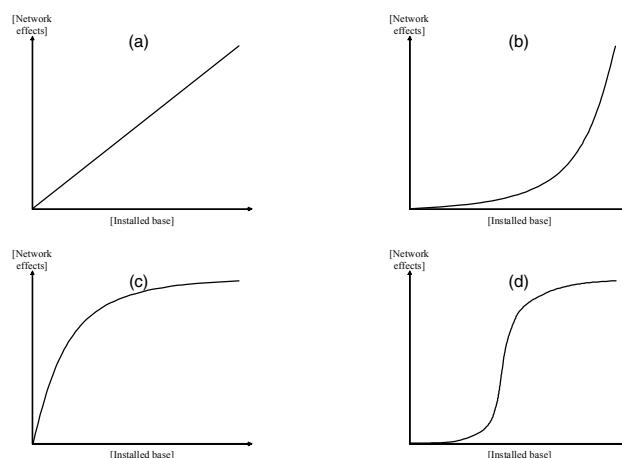nt the assumption that network effects are indefinitely increasing in a social system. In contrast to this, the concave and the *s*-shaped functions express the assumption that network effects are limited by a saturation level. However, while in the case of a concave function (Figure 1c) every later adopter causes lower additional network effects than earlier adopters, the *s*-shaped function (Figure 1d) is a mixture of the convex function with a low installed base and the concave function with a higher installed base. As the problem of the functional relationship between network effects and the installed base has not received much attention in the literature, there is no clear indication on the real relationship.

In reference to the network effects' dependency on the number of users, An and Kiefer (1995) differentiate between network effects that depend on the worldwide installed base (global network effects) and networks effects that depend on the number of neighbouring users (local network effects). However, the abstraction from the identity of the users of a communication product often proves inadequate when practical questions are tackled (Rohlfs, 1974). As communication products serve the satisfaction of communicational needs, network effects naturally depend on the form of an individual's communication network. When deciding about the adoption of a camera cell phone, for example, people create high network effects with whom the potential adopter wants to exchange photos or videos. Therefore, it can be assumed that the adoption of people with whom the individual communicates more often or more intensively creates higher network effects than the adoption of people with a lower frequency or intensity of communication. Furthermore, groups of individuals exist, each of which display a similar communication frequency and intensity regarding the individual, thus making it necessary to differentiate between groups characterized by similarly high network effects for the individual (Voeth & Liehr, 2004).

Figure 1. The functional form of network effects

NETWORK EFFECTS AND THE INDIVIDUAL CRITICAL MASS

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