Technology standards and increasing returns: Microsoft versus Nokia and Linux

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Abstract: The purpose of this article is to advance theory on the concept of increasing returns by reviewing different strands of literature (Arthur, 1994; Liebowitz and Margolis, 1990; 1994; David, 1990) and to develop the concept of a 'critical mass' strategy which incorporates both technological effects and important social network and interaction effects, which also need to be part of the business strategy in an increasing returns environment. Such concepts are further developed on the basis of an apparent conundrum in the case of mobile phone software, where the operating system standards of Symbian and Linux are part of the competitive struggle between Nokia and other vendors and Microsoft, despite their invisibility to the end user.

Keywords: Nokia; Microsoft; Linux; Symbian; open source; increasing returns.

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1 Introduction

Competition amongst technology based standards has been well researched in the economics, technology and information systems literature at least since the 1990s (Shapiro and Varian, 1999). Well known examples include the competition between Philips/Sony's Betamax and Matsushita's VHS; Apple versus IBM; QWERTY versus DVORAK keyboards (Arthur, 1994; David, 1990; Liebowitz and Margolis, 1990; 1994). In this paper we argue that fuller analysis of situations such as these illustrates the importance of looking beyond the technology standards themselves, and putting a greater emphasis on the importance of the social network, and the social interaction effects that can lead to the diffusion and acceptance of a particular technology-based product. We see both types of factor as underpinning the creation of critical mass in the market place, which in turn becomes manifest in increasing returns (Arthur, 1994; 1996; Dickson, 1995).

Our approach responds to the strategic question of how to seek such 'increasing returns' whereby success can often be dependent on achieving a sufficient mass of clients, which when reached, can lead to a further increase in clients. The Austrian School of disequilibrium in the market place complements such ideas, and helps bridge the gap between evolutionary economics (Nelson and Winter, 1982) and business strategy. In addition to making a contribution by integrating the importance of social effects, we consider how such technology standards affect the supply and distribution chain and how interactions in these areas can create additional impulses towards achieving critical mass – through social effects as well as technical.

As illustration, we analyse the growing global competition in the area of 'software standards' for mobile phones. This has become a global, three-way competition among Microsoft, Nokia and manufacturers favouring Linux open source systems. We explore the factors which make this competition much more complex than the earlier competitions in videos, personal computers and keyboards. We note that although this competition is currently almost invisible to the consumer, it is none the less about the wish to achieve (or deny to others) the critical mass that leads to increasing returns. We find that the enhanced theoretical framework developed is capable of accommodating a plausible explanation, and propose further research to underpin this.

2 Increasing returns: critical mass and social effects

The concept of increasing returns (Arthur, 1994; David, 1990; Liebowitz and Margolis, 1990; 1994) is a dynamic one and relies on the importance of positive feedback mechanisms, whereby an advantage or disadvantage becomes self-reinforcing. Recent industrial examples on the technological side of this phenomenon include Philips/Sony's Betamax versus Matsushita's VHS competition in the video industry and the Apple versus (IBM) PC competition for personal computer hardware.

Increasing returns are predicted in the technological standards literature, which focuses on the importance of setting a technological standard in an industry, including by Katz and Shapiro (1985), Farrell and Saloner (1992) and Shapiro and Varian (1999). However the technology standards research, which is linked to the technology licensing literature within marketing such as Capon and Glazer (1987), Achrol (1991), Anderson and Narus (1990) and Kotabe *et al.* (1996) has not analysed the more social components of client base development and systems of components and products.

Some of the earlier developments of the role of such social factors were analysed from a sociological perspective by Schelling (1971; 1978) in terms of the importance of the client base in competition. The general importance of social interactions for the diffusion of technology, products and services has been analysed by Abrahamson (1993) and Choi *et al.* (1997).

Arthur (1994; 1996) has defined the differences between increasing returns and traditional economic analysis as the following:

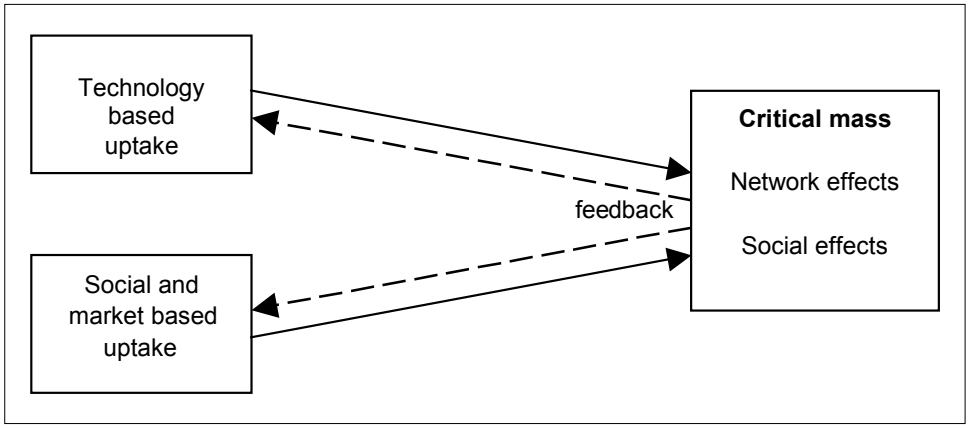
> "...the assumption of diminishing returns: products or companies that get ahead in a market eventually run into limitations so that a predictable equilibrium of prices and market shares is reached...increasing returns are the tendency for that which is ahead to get further ahead, for that which loses advantage to lose further advantage."

This gives rise to the concept of 'critical mass' which, once achieved, will be the basis of continued growth – on the analogy of a chain reaction. From the viewpoint of the firm this leads to the search for a strategy based on this effect. We would define such a 'critical mass strategy' as:

> "...a strategy which seeks increasing returns in a competitive environment making use of frameworks which are dynamic in nature through the incorporation of positive and/or negative feedback mechanisms."

Thus our critical mass approach differs from the broader increasing returns research in economics of Arthur (1994; 1996) and Krugman (1996), and this is so on a number of points. Our focus is on the implications of such effects at the firm level, such as the way critical mass take-off points can be moved, shifted or changed through a firm's strategy. As also discussed by Dickson (1995), we believe that there is a need to analyse the narrower, marketing oriented issues such as the distribution relationships, innovation, diffusion and new product developments. Further, we take into the account the important role played by social networks and the interactions between firms within an industry, which help to create the positive and negative feedback mechanisms crucial for increasing returns effects to exist (Choi *et al.*, 1997; Lee *et al.*, 1997). In order to develop a framework for critical mass based marketing strategy, there is thus a need to analyse consumer affecting issues like information diffusion, word of mouth, shelf space, switching costs, and channel good will (Dickson, 1992; 1995). We believe that the phenomenon is crucial for analysing particularly those industries where there is interaction and social communication among customers. These interactions, if they reach a certain critical mass level, can in turn become self-reinforcing, leading to a rapid and exponential growth in sales and profits for such firms or coalitions of firms. Thus, there is a need to go beyond the purely technological issue of a firm's strategy, and to combine it with the more social aspects of path dependency. Figure 1 presents a view in which both aspects, and their mutual interactions are represented.

Figure 1 Critical mass: technological and social feedback



3 Stages of critical mass marketing

In many cases firms competing for critical mass are more market share than profit driven, showing the importance of aggressive market penetration and locking-in of distribution channels (Dickson, 1995). The profits arise at exponential, rather than linear rates at a later time, when the lock-in has been created; this has significant implications for a firm's marketing strategy when it is coordinated with the firm's other general strategies, such as rapid high return of profits to shareholders. The importance of such distribution lock-in is clearly illustrated by looking at the strategies employed by Matsushita and by Sony/Philips. Matsushita used a marketing strategy of franchising its VHS and video technology in order to achieve critical mass in market share despite diluting its revenue and exposing its technology, while Philips/Sony kept their Betamax technology in house so as to reap profits anticipated as assured because of their superior technology. The distribution lock-in eventually helped Matsushita to dominate the whole video industry, with a product that is considered as lower in quality to the Betamax technology. Another example is IBM versus Apple hardware, where IBM ultimately welcomed the cloning of its PCs and the numerous subcontractors, add-on peripheral manufacturers and distribution channels which built businesses around that design. By contrast, Apple, with superior quality in hardware and software, persisted with the traditional marketing strategy of protecting its technology and focusing on profit rates, in turn becoming locked out of the major part of the market.

The lock-in of distribution channels and linked producer firms is significant because it creates momentum and ongoing power in the market place. On the one hand this ensures that product availability continues into the period when superior returns are earned. On the other hand as the market share or client base develops, reputation and customer loyalty begins to develop and for both the distribution channels and original equipment manufacturers this loyalty is reinforced through the signalling effect (see below) of their relationship.

Many marketing theories are based on the inter-relations between a single firm and its customers, while strategy theories often are based on the inter-relations between different firms. Critical mass, on the other hand, is a function of both marketing and strategy theories where it incorporates a firm's relations with its customers and social and technological feedback loops as well as with its environment of other firms.

The significance of lock-in, especially in critical mass driven markets, extends to related product/service sales. In today's environment of complementary technologies and systems (Kotabe *et al.*, 1996), firms with a high reputation or those that have achieved critical mass in one market try to create a 'lock in effect' in other markets. They attempt this by bundling products or networks together and so closing out competition in more than one market. For example, most new IBM compatible computers sold today arrive with a version of Windows, in a sense locking out any other type of product or system. This bundling phenomenon comes about in an attempt to reap increased market share based on complementary networks and reputation.

4 Social interaction and herding

Another factor that can lead to the development of critical mass and increasing returns effects is the way information is communicated within the market. One key way in which information is diffused in the markets especially on information based products is through 'word of mouth' communication, through social and community networks. As discussed by Dickson (1992; 1995), in terms of marketing strategy, such communication effects need to be analysed along with issues such as shelf space, switching costs and good will. Several pieces of research have emphasised the information acquisition process and set out to integrate such work with research on decision-making, competition and communication. For example, Griesinger (1990) shows that interpersonal and non-market resources often play an important role in decision-making and information acquisition. Reed and DeFilippi (1990) have discussed informational ambiguity and how to use it to develop competitive advantage. The difficulty of assessing product quality, especially when there is uncertainty in the environment, which is often a factor in herding behaviour, has been analysed in Choi *et al.* (1997), Gabbott and Hogg (1996), Bitner *et al.* (1994), Cronin and Taylor (1992) and Parasuraman *et al.* (1994).

Herding occurs when a consumer's choice depends on the decisions of others, helping to accelerate the process of critical mass build-up, social lock-in effects and increasing returns. Such effects may be linked to technological lock-in for industries such as computer software, or separate from technology in other industries. The classic case of consumer herding is fashion. In this industry choice is by definition dependent on what is in vogue. Such herding, or concentration, in buying behaviour also occurs for a particular product or the output of a specific firm. In these cases brand or market images are built on the choices made by others. The information that is influential for customers includes their observation of others as customers or potential customers. Service providers with a large clearly identifiable client base in the market or segment have, we would argue, a clear competitive advantage, because their client based serves as a signal (Spence, 1973) of quality or position in the market.

This process may determine if one or the other network will acquire momentum and be successful by achieving critical mass. Reinforcing feedback loops are the main underlying forces that drive increasing returns. As we mentioned earlier, there are two main types of feedback loops: technical and social feedback loops. Shapiro and Varian (1999), Katz and Shapiro (1994) and Farrell and Saloner (1985) have analysed the technological aspects especially in terms of economics of standards and regulation. Our focus in this paper however is on the more social aspects of networks, feedback loops, and critical mass formation.

Most individuals are expected to know very little about the whole environment and the way it operates. As a result individuals respond to an environment that consists of others responding to their environment (Schelling, 1978). This leads to a belief that in many cases individuals locate themselves voluntarily in some pattern that does not necessarily possess apparent advantages even for the individuals who by their own choices form the above pattern. This herding or tipping phenomenon is hard to explain especially when one assumes that an individual is rational and has clear motives and objectives. This (part) irrationality leads to unintended and unanticipated consequences as the aggregate of individual behaviour leads to uncanny results that one is unable to predict from the aggregate of individual motives and objectives.

The social feedback loop is a process whereby firms and customers subscribe to a network, not because of their individual assessment of the innovation's efficiency or returns, but because of a bandwagon pressure caused by the sheer number of firms and individuals that have already adopted the same network (Abrahamson, 1993; Tolbert and Zucker, 1983). We call this herding, and herding occurs when a consumer's choice depends on the decisions of 'others' (Choi *et al.*, 1997). It claims that sheer numbers of firms and customers adopting a network at an early stage creates a pressure causing others to adopt this network at a later stage (Abrahamson, 1993). One way to analyse the framework of critical mass management is to compare the main drivers of such a strategy to the more traditional industry analysis and ideas of competitive strategy.

Critical mass management provides a more dynamic analysis of markets and industries and firms must constantly assess the various positive as well as negative feedback mechanisms (Choi *et al.*, 1997). These feedback mechanisms can be driven by technology standards, as well as by more psychological and social network effects. Underlying both concepts is Dickson's (1992; 1995) framework of competitive rationality, which draws on the idea of disequilibrium in the market place.

5 Software standards competition for mobile phones: Microsoft versus Nokia and Linux

A global competition has begun for the software standards for mobile telephones. Various global stakeholders are involved in this competition including telecom operators, hardware integrators, software manufacturers, and hardware manufacturers. The complexities of this competition are far greater in comparison to the earlier standards competitions of Apple versus IBM or Betamax versus VHS. We can distinguish a threefold complexity.

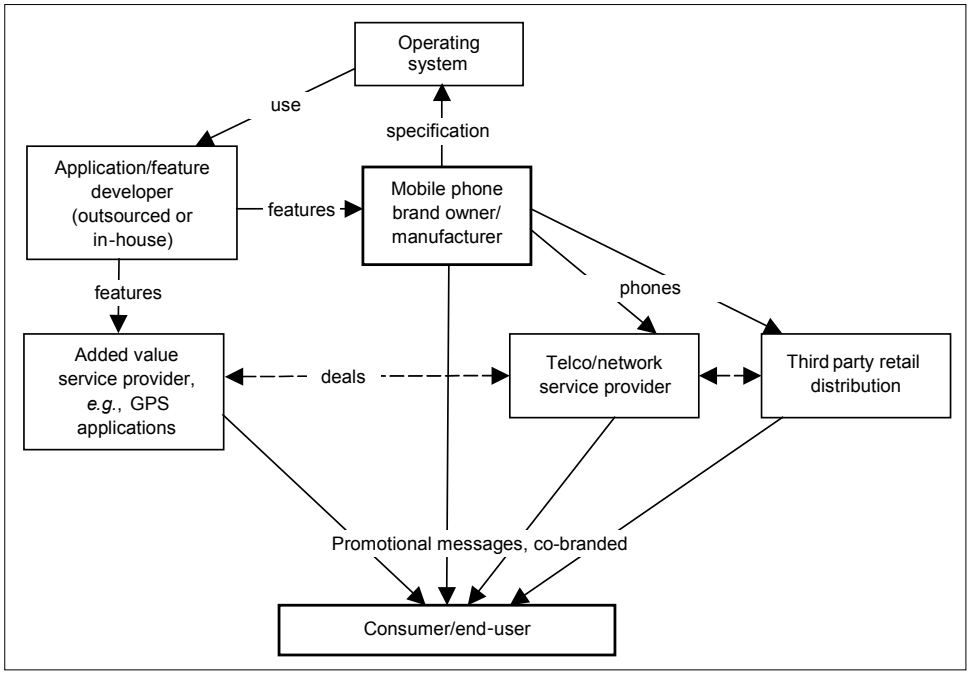
First, it is about a three-way competition involving Microsoft, Nokia and the manufacturers adopting Linux. Nokia's role is as major backer of the consortium of mobile handset manufacturers which offers the Symbian operating system; Linux builds on the open source software phenomenon (Von Hippel and Krogh, 2003). Second, while the markets are global, the competition pits US, European and Asian players against each other. And third, the competition involves standards that are barely visible to the end-user of the products concerned, making the scope for network effects almost absent.

There are however key differences among the three strands in that Nokia, using Symbian, and Linux are representatives of an 'open system' approach in which various competitors have access to the same technological standard, allowing potentially closer sharing and collaboration, while Microsoft appears to be following a relatively closed approach. An interpretation of this is that Microsoft aims to benefit from perceived affinity and consequent lock-in based on its proprietary Windows PC operating system.

This market is of particular value in assessing theories on the impact of competing standards and the development of increasing returns both because if its size and the clear strategic intent of many players to achieve critical mass. The complexity of the market appears a barrier, but is of importance because it reflects the real world of globalised competition combined with specialised, often networked commercial roles. There are numerous stakeholders involved including hardware manufacturers and

software developers, add-on applications developers, network operators and independent distributors. The group of major stakeholders and the main lines of communication in the market are shown in Figure 2 below.

Figure 2 Structure and main flows in the mobile phones market



In the 1980s and 1990s, the competition for the standard in personal computers hardware and software among Apple, IBM and Microsoft proved to be one of the biggest business issues in technology and information systems. The merits of adopting a relatively 'open' approach appear to have been established through the success of the IBM compatible PC, and while Windows itself remained a closed standard its association with the PC and the adoption of Windows for a large proportion of independent software development appeared to support the case for ubiquitous distribution and the involvement of parallel exploitation by other companies as the basis for achieving critical mass and increasing returns.

Application of this observation as a lesson for the mobile phone industry would argue in favour of the model adopted by Nokia and even more so for that of those companies choosing Linux. There is however a significant difference in this case which theory needs to deal with. The theoretical basis discussed above relates the success of the 'open' strategies to their impact at the consumer level; consumer choice is taken, as in the case of VHS versus Betamax, to have been influenced by factors such as the signalling effect of many manufacturers and software producers adopting the same format, by bandwagon and possibly herding phenomena, and possibly also by network effects.

In the case of mobile phone operating systems however the consumer is rarely presented with information about the operating system being used. With the exception of discussions amongst a small group of technologically sophisticated enthusiasts and

innovators, the operating system is not mentioned, it is only the features that are emphasised. And when any operating system fails to support a popular feature it is rapidly provided. Fashion phenomena and herding are observed in the mobile phone market; however they focus on brand, style and feature sets, not on operating systems. Thus it is highly unlikely that most users are aware of the operating system used on their phone, or on the phones of others. Against this background it is important for theory to provide an explanation for the strenuous efforts of Nokia to support Symbian, and of other manufacturers to adopt Linux as a standard, while Microsoft promotes Windows Mobile through a variety of manufacturers and channels. This paper attempts to do just that.

The critical mass development model portrayed earlier extended previous economics-oriented work on increasing returns by incorporating the important role played by social networks, postulating that the two combined could be the basis of a critical mass strategy. We also referred to the interactions between firms within an industry, helping to create the positive and negative feedback mechanisms crucial for increasing returns effects to exist (Lee *et al.*, 1997). Alongside these factors we referred to the use of the 'lock-in' effect as a means of securing increasing returns for one product through linkage to another.

The creation of the Symbian consortium can be seen in the light of these latter aspects. Its foundation in 1998 brought together a number of companies whose further expansion would be threatened if Microsoft were to be able to achieve transfer lock-in in the mobile phone market. Nokia's ambition to contest areas that Microsoft would also covet is clear from its mission statement:

> "We intend to capitalize on our leadership role by continuing to target and enter segments of the communications market that we believe will experience rapid growth. … we plan to lead the development and commercialization of higher capacity networks and systems to make wireless content more accessible and rewarding to the end user." (Nokia, 2002)

Microsoft was, however, at that time not a serious contender in the mobile market, particularly not as a prospective manufacturer, whereas several of the other companies with which Nokia formed Symbian were significant competitors in exactly the same markets. Some particular factor must be seen as giving rise to the need to counter Microsoft's ambitions (Ancarani and Shankar, 2003).

The mechanism which Microsoft proposed to use to enter the market was to recruit developers to use its operating system and operators to specify it in their negotiations with mobile phone manufacturers (Léger *et al.*, 2000). While this appears to be a technology-based approach, we suggest that – in line with the theoretical discussion above – it is an approach based on the wish to create an environment in which it would be possible to exploit the signalling effect of widespread availability and the lock-in transfer effect of perceived superior compatibility with Microsoft Windows in order to stimulate social and market-based uptake leading to critical mass and increasing returns. While this has not yet been evident in marketing from Microsoft – there has been no analogy to the 'Intel Inside' campaigns – it remains a potent threat and it is notable that despite some problems and an expectation of defections the Symbian consortium continues to survive.

In the case of the more recent growth in the use of Linux, particularly for mobiles sold into Asian markets, an analogous but reverse motivation may be at work. That is, Linux may appeals to manufacturers not only because of its technical merits and open source status but also because it reduces the risk of having to choose Symbian or Windows and, through its association with increasingly popular Linux computer software, it appears capable of becoming a vehicle for creating a social and market uptake in competition with the others if operating systems become a consumer issue in the future.

6 Conclusions

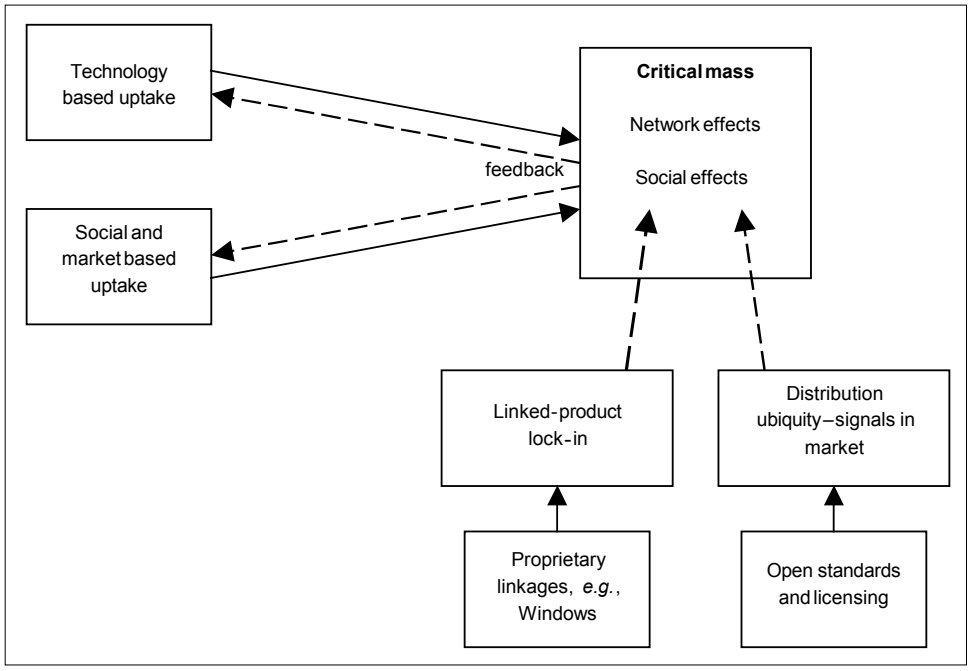
Since the 1990s technology based standards competition has been well researched in the economics, technology and information systems literature. Increasing returns effects were shown to potentially exist in technology based industries such as the personal computer or video-tapes. In the 21st century a similar global competition appears to be growing in the area of 'software standards' for mobile phones. This paper took this growing global, three-way competition for the standard in mobile phone software between Microsoft, Nokia, and adherents of the Linux Open Source Systems as a case study to illustrate new thinking and analysis of the theoretical basis of the increasing returns phenomenon.

We proposed that a fuller treatment of how critical mass required to launch increasing returns arises will require the integration of both technology and social effects. We concluded that standards, although primarily presented as a technological issue, can in some cases be more important in relation to consumer response, for instance when they make possible a critical mass building claim for products that conform or undermine the claims of a competitor.

The insights gained are the following three: By its focus on the firm and its explicit consideration of the positive and negative feedback mechanisms, the critical mass strategy approach adds to the important reality issue of dynamics in strategy. Further, in the creation of critical mass attention should be paid not only to much discussed aspects such as technical network effects, but also to psychological and sociological network effects which we believe are becoming a more important component of business success, particularly in a world where communication is increasing. And third we discuss different influences on this psychological and sociological component, particularly the impact of market signals such as those that come from widespread availability in the distribution chain, and of linkages between products where one has already achieved critical mass.

Our discussion of the particular case of mobile phone operating systems revealed that the competition amongst the standards may have more to do with influencing the social and market factors affecting uptake mechanism than with the technical aspects. As illustrated in Figure 3 the competition between the promotion of an open standard (Symbian or Linux) and the promotion of a standard associated with a proprietary brand which already has critical mass, corresponds to competition between two contrasting ways to increase the social and psychological pressure for uptake of the vendors' products.

Figure 3 Open standards versus proprietary linkages as options for critical mass strategies



At least two areas warrant further research. The first is an empirical analysis of some of our conceptual proposals, looking in more depth at the developments among Microsoft, Nokia (Symbian) and Linux (Open Source Software) where such critical mass and client base factors seem crucial for competitive success. This should include consideration of the development of strategy over time and could track the stresses on the cohesion of Symbian as a function of the progress of Microsoft (and possibly Linux) based systems and of any future attempt to build in their linkages with respected computer software. The second is a further development of the conceptual ideas, especially in terms of how critical mass levels can change, or can be shifted due to different developments in the structure or market conditions of an industry.

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