ABSTRACT

Path dependence in interorganisational networks has been under-researched so far. The effects that network structures exert on inter-firm relations and flexibility have rarely been discussed nor have corresponding mechanisms been identified consistently. I seek to close this research gap by creating a theoretical framework that integrates three streams of literature: the network approach in interorganisational networks, path dependence theory and structural social capital. I conceive of social capital's structural foundation as one possible driver of path dependence. Evidence from an exploratory case study in the smartphone industry is used to illustrate this framework. This industry is interesting, because two competing strategic blocks are establishing internal cooperative relations that have the potential to lock-in participant firms to a certain software platform. The findings reveal a process of potentially problematic, social capital driven network closure and partly provide support for the structural arguments of the developed integrative theoretical framework.

TABLE OF CONTENTS

1 Introduction

Path dependence is a complex social phenomenon (Sydow, Schreyögg & Koch 2009) that is embedded in social structures, such as organisations. Networks of organisations are the focus of the present study. They constitute a large part of the social structure in which organisations are embedded. Because social structure is the basis for firms' activities and for the emergence of social mechanisms, studying interorganisational network structures can strongly contribute to path dependence literature by identifying network conditions under which structure, or the processes and activities based upon it, can drive path dependence.

Networks have mainly been ignored as an analytical focus in path dependence research, with few exceptions (e.g. Walker, Kogut & Shan 1997). This lack of studies is surprising given that overall networks are receiving ever-increasing attention in business research (Zaheer, Gözübüyük & Milanov 2010). Furthermore, high-tech industries being relevant to path dependence because of standardisation heavily rely on network structures. Typically, scholars argued and provided convincing empirical evidence that interorganisational networks are an inherently flexible and thus advantageous form of organising cooperative ventures (e.g. Powell 1990). However, the coin may also have a flip side in terms of network-induced inertia or even path dependence for the participant organisations which may arise from a lock-in into certain network structures.

The processes and mechanisms leading to network path dependence are not well understood yet. In particular, in the discussion of path dependence mechanisms, structural arguments have rarely been employed. The goal of this paper is thus to improve our understanding of network-induced path dependence. I propose a theoretical framework that integrates three theories: the network perspective on interorganisational relationships (Gulati, Nohria & Zaheer 2000; Zaheer, Gözübüyük & Milanov 2010), path dependence theory (Sydow, Schreyögg & Koch 2009) and a new perspective on social capital (Burt 2001; Coleman 1990).

Evidence from an exploratory case study on two interorganisational networks in the smartphone industry serves to illustrate this new framework. The smartphone industry is a rapidly growing part of the TIMES[1] sector and useful to apply the developed framework for three reasons: First, the emergence of new customisable operating systems and related software ecosystems (hereinafter: platforms) has established two powerful strategic alliances competing for the success of their respective platform. Second, these cooperative networks encompass many formerly unrelated firms and the process of developing interaction brings about new structures. Third, the process in which this new structure emerges is still unfolding and can thus be studied in the present.

This study contributes to path dependence theory, because it newly addresses the question of how path dependence may arise in interorganisational networks. I argue that path dependence is driven by structural processes that arise and affect the development of cooperative relations and network member flexibility. The study extends research on interorganisational networks by answering the call for more focussing on the 'dark sides' of networks (Zaheer, Gözübüyük & Milanov 2010: 71). In addition, it reunites two conceptualisations of structural social capital (Burt 2001; Coleman 1990) that were formerly seen as opposing and identifies this as a driver of path dependence. Finally, with the smartphone industry, the study explores an emerging field which may soon create globally relevant standards for more than 4 billion users.

The study is structured as follows: First I introduce the theoretical basis consisting of the interorganisational network approach, path dependence theory and social capital and then elaborate on the proposed integrative theoretical framework based on these three perspectives. Second, I employ an exploratory case study and present the findings to illustrate the applicability of this framework. Lastly, after discussing the findings with regard to their ability to illustrate the framework, I briefly outline future research regarding this new framework.

[1] TIMES: Telecommunication, Information technology, Multimedia, Entertainment and Security

2 Theory

The following section provides an understanding of what networks are and what research exists on networks. Path dependence theory is then related to structural social capital, since it drives the path dependence of interorganisational networks.

2.1 Interorganisational networks and strategic alliances

Network research addresses the issues related to the fact that actors do not act and behave fully independently and autonomously, but are connected to others in the social realm (Gulati 1998: 295). 'Network' may cover any relations among social entities ranging from individuals and their work relations to interorganisational economic exchange. The latter are interesting, because many modern industries e.g. of the *New Economy* are network(ing) industries (Sydow 2006b: 390) and employ these "network forms of organisation" (Podolny & Page 1998).

Research on networks has become important since Granovetter's seminal studies "The Strength of Weak Ties" (1973) and "Getting a Job" (1974). His sociological research on information access has made the network approach popular in most social sciences, including economics, social psychology, business and management research.

In economics, networks have been discussed as a "network form of governance" (Powell 1990), meaning a hybrid transaction governance employing elements of both markets and hierarchies (Williamson 1991). Hennart argues that such hybrid arrangements are used in most transactions (1993: 529). Networks are also discussed under the concept of 'network effects' or 'network externalities' (Liebowitz & Margolis 1994), i.e. the utility of a product increases with the size of the user base of that product (direct network effects), or the user with the user base of a complementary product ('indirect network effects') (Clements 2004).

While economic approaches acknowledge the existence of networks on an aggregate level, they tend to ignore social structures, relational characteristics and their consequences for individuals. Management and business scholars embraced the central notions of

connectedness and the “social embeddedness of action” (Granovetter 1985) much more intensely.

Studies elaborate on antecedents, formation, effects and outcomes of networks and are concerned with a wide range of analytical foci: from individuals, such as managers and the networks they create in their work environment (Iseke 2009; Gargiulo & Benassi 2000), Asian family empires (Carney & Gedajlvic 2002), firms (Liebeskind et al 1996), to multi-level networks between individuals and firms (Sydow & Staber 2002), and even regional networks and clusters (Marquis 2003; Grabher 1993). Interorganisational networks are important in the setup of industry structures, intra-industry structures, for the access to resources and capabilities, for contracting, coordination costs and economic returns (Gulati, Nohria & Zaheer 2000). Particularly, the arguments regarding access to resources and information that can be achieved through membership in certain sub-groups of industries, “strategic blocks” (Gulati, Nohria & Zaheer 2000: 2006) are important for the present study, because they constitute important motives for firms to join such networks.

Research on interorganisational networks typically focuses on a single level of analysis (ego, dyad, network) and the effects of selected theoretical mechanisms, such as resource access, trust, power/control or signalling (Zaheer, Gözübüyük & Milanov 2010: 67). Networks tend to be beneficial for member firms. They are flexible forms of organising economic and other exchange activities, e.g. learning (Powell, Koput & Smith-Doerr 1996), and competitive advantages arise from organising in this way (e.g. Liebeskind et al. 1996). They can also enhance the ability to absorb knowledge (Belussi & Arcangeli 1998: 415), improve chances of survival (Uzzi 1997), provide “access to information, resources, markets, and technologies” (Gulati, Nohria, Zaheer 2000: 203) or increase the ability to innovate (Ahuja 2000). In sum, interorganisational networks provide firms with particular advantages that would otherwise not be obtainable.

Conversely, other streams of literature identify problematic issues, e.g. network inertia (Kim, Oh & Swaminathan 2006) or lock-ins (Gulati, Nohria & Zaheer 2000). Networks can have a ‘dark side’ due to network-induced inflexibility to enter other, potentially more beneficial, relationships (Hagedoorn & Frankfort 2008: 511) or network-related constraints that lock a

firm into undesirable relations or positions. This can decrease firm performance, make them vulnerable to exogenous shocks, reduce their survival chances or disconnect them from information sources and other resources beyond their immediate network (Uzzi 1997: 35). More generally, historic relationships influence the formation of new ones (Gulati 1995) and pose "constraints on behavior" (Brass et al. 2004: 795).

While addressing a 'dark side' of networks, these accounts may strongly benefit from an approach that focuses more on the **process** of becoming increasingly locked-in: path dependence theory. This theory emphasises the ambiguity that can turn a seemingly beneficial situation into a problem for actors, e.g. when firms or even an entire market become locked-in to a single solution due to historical events that are amplified by positive-feedback processes (David 1985; Arthur 1989; Sydow, Schreyögg, Koch 2009).

2.2 Path dependence

In contrast to neo-classical logic that rational agents make fully informed decisions and will thus not make inferior choices, David (1985) shows that markets do not necessarily achieve the best, i.e. efficient, solution. David (1985) and Arthur (1989) argue that even inefficient products or services can become so 'successful' that they constitute a market standard. The famous QWERTY case illustrates how technical-interrelatedness, economies of scale and quasi-irreversibility of investments in conjunction with seemingly random historical events can lead to a literally global lock-in to an inefficient solution. Arthur (1989) reveals how increasing returns are responsible for lock-ins. Both Arthur and David use technical standardisation as illustrative cases, because these are prone to path dependence.

Based on historical economics studies, path dependence theory focuses on persistence and positive-feedback mechanisms that can lead to lock-ins mainly at a market level. Schreyögg, Sydow and Koch (2003) and Sydow, Schreyögg and Koch (2009) extend the applicability of path dependence theory to the analysis of organisational and strategic settings. They conceive of path dependence as a three stage process. The first stage (preformation phase) is characterised by small events that diminish the scope of action for involved actors. It ends

with a “critical juncture”, the point at which elements of the process are no longer non-ergodic, but become deterministic to some degree.

The second phase (path formation phase) involves the development of at least one positive-feedback mechanism that reduces the ability or likeliness of actors to deviate from their chosen option. The third and final stage in the path dependence process is the lock-in to an (at least potentially) inefficient or ineffective choice. Actors find themselves deterministically bound to only that solution, no longer recognising other options available. Even if these alternatives still exist, actors’ commitment, perception or ties to other actors may make it impossible or at least costly to switch. Thus actors stick with their previous choice.

Sydow, Schreyögg and Koch’s (2009) three-stage model for the analysis of path-dependence places particular emphasis on the study of social positive-feedback mechanisms, e.g. coordination effects, learning effects, complementary effects and adaptive expectation effects, because they may lead to lock-ins at an organisational or strategic level. The strength of this extended conceptualisation is this focus on social mechanisms and causal relations between events, processes and structure.

Walker, Kogut and Shan (1997) address persistency in interorganisational networks. They do not, however, make full use of path dependence theory. Compared to the three stage model, they remain at a rather metaphoric level, mainly employing the ‘history matters’ argument, but they identify a social mechanism that is responsible for path dependence in networks: social capital.

2.3 Social capital

Social capital theory originates from social network theory and analysis (Borgatti et al. 2009: 894), but despite application across many academic disciplines, it is not a clear-cut concept (Adler & Kwon 2002). It describes the idea that certain positions, resources or actions within a social group can lead to a competitive advantage for actors that are rich in this type of capital. According to Bourdieu ‘social capital’ consists of the “actual or potential resources which are linked to possession of a durable network of […] relationships […] or in other

words to membership in a group" (1986: 248). Similarly, Maurer & Ebers (2006: 262) define it as "an asset available to individual or collective actors that draws on these actors' positions in a social network and/or the content of these actors' social relations". More generally it refers to the value of connections (Borgatti & Foster 2003: 993). With regard to interorganisational networks, social capital scholarship is divided into two 'competing camps' with opposing implications and explanatory approaches.

The first group follows Burt's (1992, 2005) ideas: Social capital accrues to an actor who 'brokers' between otherwise isolated actors or groups within a network or market. This actor has relationships with at least two other social entities which have no direct connection between themselves. The term 'structural hole' describes the position of the connecting actor, which, if empty, would leave a hole in the network. The ability of an actor to exploit the brokerage potential arising from this position leads to a competitive advantage for the broker relative to others. This advantage comes from having some degree of control over the flow of information, resources or cost reduction benefits through the information gained in the bridging process (Burt 2001: 4-7).

While these "bridges are a by-product of pursuing other ends" (Burt 2005: 28), incentives may exist for a broker, e.g. estate agents, investment banks or head hunters, to keep the two parties they connect essentially separated, since this allows them to capitalise on their (information) disadvantage. All bring parties together like a "convenor" (Brass at al 2004: 804). Overall, the brokerage position can lead to performance advantages and the network structure allowing for brokerage forms the social capital of the broker.

Zaheer & Soda consider the emergence of structural holes positions a central feature of network structures and an important antecedent of organisational outcomes (2009: 4). They emphasise the ambivalence of opportunities arising from, and structural constraints imposed by past network structures in network evolution. While opportunities arise for actors to "enact future structures (2009: 25)", i.e. brokerage positions, there are also constraints imposed by structures from the past. These constraints can result in a lock-in to certain network positions. They are driven by the historical exploitation of brokerage opportunities which may be beneficial (for some time) and the more or less purposeful

agency of actors in reproducing these structures. Although the extent to which structures like brokerage positions can be actively created remains uncertain, they may make it “harder for focal actors to break out of redundant network structures (Zaheer & Soda (2009: 27)” and lead to suboptimal outcomes.

The second relevant group of social capital scholars embraces Coleman’s (1988; 1990) argument that social capital exists for all actors that are members of networks with many internal relationships. Strong ties generate high network density which leads to the internal cohesion of a network. Connections between, at best, all members of a group lead to strongest social capital. Ascribed positive effects are based upon e.g. information access advantages through increased trust, reputation and sanctioning effects (1988: 107f) and solidarity benefits that facilitate cooperation and exchanges (Adler & Kwon 2002: 33). “The amount of social capital available to an actor is thus a function of the closure of the network surrounding him” (Gargiulo & Benassi 2000: 184). Closed networks are beneficial since they disenable the possibility that defaulting behaviour may go unnoticed: “The more closed the network, the more likely that misbehaviour will be detected and punished (Burt 2005: 97)”. Actors fearing reputation loss within a network must adopt its norms of cooperative behaviour, e.g. exchange reciprocity, in order to keep their reputation which they rely upon for building beneficial relations. Incentives for closing a network exist in situations where shared norms, of behaviour control and mutual trust are beneficial for actors’ cooperation.

Scholars at least implicitly identify possible constraining effects of network closure: control (Gargiulo, Ertug & Galunic 2009) or obligations arising from social norms like reciprocity, and actors’ related inability to free themselves from unproductive relations which reduces their subsequent performance (Gargiulo & Benassi 2000: 185). “Although prior networking and close ties can enhance trust, it is possible that actors can become overly embedded in their networks, become risk averse, and continue to work with others because of the strong ties among boundary spanners. Overembedded actors may miss cost-effective opportunities with other actors” (Brass et al 2004: 803).Overembeddedness can lead to rigidity that makes actors continue existing relations and prevents them from entering eventually fruitful new (types of) relations or networks if “higher density within an interorganizational clique led to fewer exits from the clique” (Brass et al 2004: 804).

2.4 Making connections

The applicability of social capital theory to interorganisational networks is included in its roots (Burt 2001: 2) and has been demonstrated by several authors (Duysters & Lemmens 2003; Maurer & Ebers 2006; Zaheer & Soda 2009). However, questions remain open with regard to network patterns, processes and dynamics (Todeva & Knoke 2002). A combination with path dependence theory makes sense, because it focuses on process dynamics and effects unfolding over time.

Furthermore, literature employing either of the 'opposing' social capital conceptualisations views high social capital as advantageous for actors. However, negative effects occur and need to be addressed. For instance Walker, Kogut and Shan (1997), Duysters and Lemmens (2003) and Maurer and Ebers (2006) argue that social capital can constrain network actors' scope of action within a shared social sphere. This causes persistence in terms of 'network inertia' (Kim, Oh & Swaminathan 2006). Recent studies point towards the ambivalence of social capital (Garguilo & Benassi 2000; Hagedoorn & Frankfort 2008). Such ambivalence is a key element of path dependence theory, because it addresses how a formerly beneficial course of action may turn into a harmful rigidity.

A first link of social capital theory and path dependence in interorganisational networks has been made by Walker, Kogut and Shan (1997) who show that firms reproduce structural patterns and that existing network relations affect firms in entering new relations. However, their understanding of path dependence remains metaphoric and their operationalisation of social capital as structural equivalence is debatable. While longitudinal in ambition, their study is a comparative static analysis. This is a typical problem of network and social capital studies which tend to be 'snap-shots' of an ego network around a focal actor. These problems may be remedied by basing the analysis on path dependence theory, because of its focus on temporal developments and by more broadly analysing 'whole networks', because this can reveal how networks and their structures evolve, how they are governed and how "they might best be structured to accomplish the goals of individual actors" (Provan, Fish & Sydow 2007: 480), such as strategically acting 'hub firms' (Jarillo 1988: 32).

2.5 An integrative theoretical framework

The framework derived from the three theories combines both structural social capital conceptualisations whose logics have often been held to be mutually exclusive. They are integrated into a processual framework with the three-stage path dependence theory (Sydow, Schreyögg & Koch 2009) and its temporal logics and cumulative inertial forces.

In the first phase, small events occur, i.e. first inter-firm connections are being established. Burt's "There is at any moment a network" (2001: 3) means that even in the absence of concrete interaction, network relations exist at least in bi-directional or uni-directional awareness. Out of potential linkages, certain ones become activated. These relationships, bridge structural holes in that they connect actors from formerly unconnected realms of an industry or even different industries. Such relationships hardly occur by chance in the way that small events in path dependence theory are sometimes claimed to occur. This still fulfils the criterion of non-deterministic developments at the beginning of the process with regard to outcome (Sydow, Schreyögg & Koch 2009) since it is unclear if and which relations or positions may become persistent and lock-in actors. The first phase ends with a critical juncture, when official alliance announcements are made.

The beginning of the second phase is marked by the emergence of concentrated interaction, cooperation or resource exchange. Through a social positive-feedback mechanism, actors' options for possible new relations are narrowed down over time. This driver is social capital, which actors seek to enlarge through network ties. Inter-firm cooperation and resource exchanges increase among members. This increases the network's cohesion and density which, according to Coleman, generates much social capital and actors seek this to facilitate exchanges. The network structure enables the building of reputations, mutual learning (Lubatkin, Florin & Lane 2001), emerging partner-specific absorptive capacity, relation-specific investments, emerging norms of cooperation, such as reciprocity or coordination exercised by lead firms. These effects make investments into existing relationships ever more valuable for alliance members. Members thus replicate relations from the past (Zaheer & Zoda 2009: 27) and enact network closure.

"Network closure is essential", (Burt 2005: 109), as a means of creating trust[2] but also for strategic reasons if closure aids the pursuit of common goals. Closure does not imply the exclusion of potential new members, since that may even be counterproductive, but that it may impede external cooperation, foster internal cooperation and prevent exits of firms from the network.

In contrast to Burt (2001; 2005), who sees closure as part of the social capital generated from brokerage, this framework considers closure a distinct source of social capital in terms of Coleman's (1990) connectedness within the network. Burt sees closure as a (potentially unwanted) by-product of brokerage and argues that brokerage and closure unfold simultaneously (2005: 127). In this framework, the processes may occur partly simultaneously, but after initial brokerage, the subsequent social capital from and incentives for closure are consecutive. Furthermore, Burt neglects strategic interventions of network members to achieve closure and only considers rigidity in trust as potentially problematic (2005: 197-223). Here, incentives for closure arise after brokerage and stability emerge through structural network closure.

The positive-feedback of closure is initially desired and sought by actors, but may turn into a vicious circle and lead to a lock-in in the final stage. Lock-in occurs when firms have become overly dependent on other network members, potentially without perceiving and, therefore, not pursuing any external alternative. This network lock-in itself may not be inefficient or ineffective for the respective actor. However, persistence in the reproduction of relations can prove strategically problematic, because structure is the basis for and carrier of the flow of resources, information etc. If potentially better interaction partners outside the network cannot be chosen due to the structural embeddedness of an actor and access to these is rendered impossible by network constraints (Duysters & Lemmens 2003), such a lock-in will be inefficient.

Figure 1 summarises the integrated theoretical framework graphically.

[2] Although, depending on one's definition of trust, Burt's ideas of deterrence are a replacement for trust.

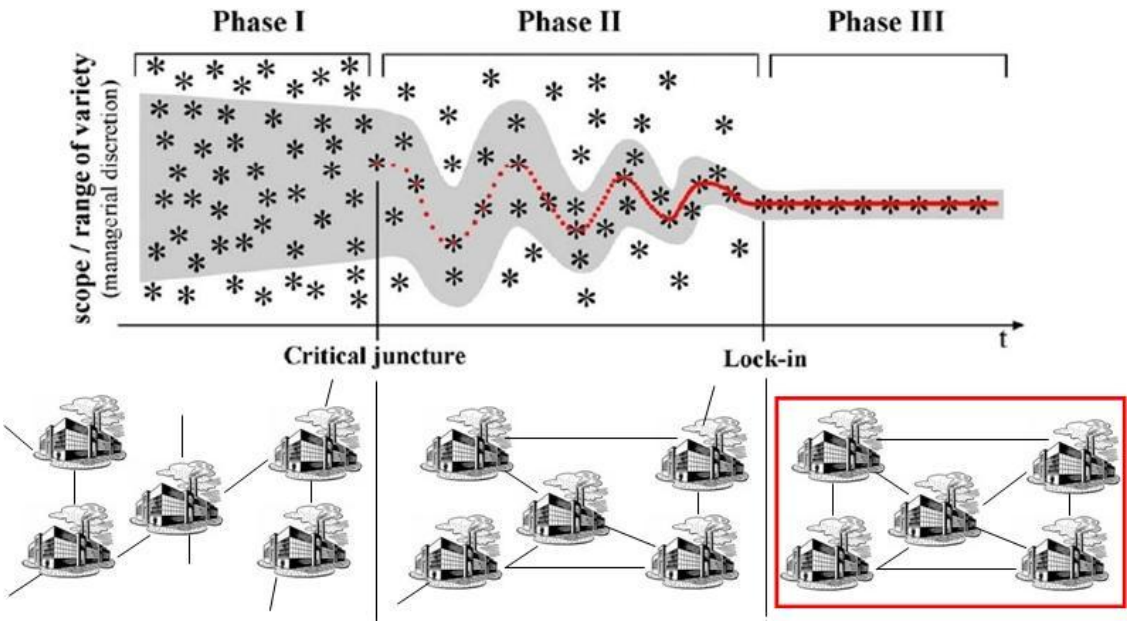

Figure 1: Integrated theoretical framework
(Source: lower half own figure, upper half adopted from Sydow, Schreyögg & Koch 2009)

3 Empirical illustration

I use an exploratory, qualitative case study (Yin 2009) for specifying the suggested integrative framework. Before elaborating on the selected empirical field, the employed methodology is described. Afterwards, the theoretical aspects will be outlined that serve as 'sensitising devices' (Giddens 1984).

3.1 Case study methodology

The case study method is particularly suitable when investigating a new empirical field and its workings. It shall serve as an illustration for developing a new theoretical approach, in the way Siggelkow (2007) suggests as fruitful: a case study is an inspiration for building new theoretical ideas (2007: 21) and an illustration for taking theoretical arguments beyond pure speculation (2007: 22). The case study will thus be used more as a means of generating or developing theory, rather than testing it (Gibbert, Ruigrock & Wicki 2008) in a grounded-theory like manner (Suddaby 2006).

In the context of the communications industry, the smartphone operating system market is treated as the case with the two networks studied being two embedded sub-cases (Yin 2009: 46). The *Open Handset Alliance* founded by *Google* is the (temporally) initial and thus critical case, while the *Symbian Foundation* founded by *Nokia* shall be analysed as a literal or theoretical replication. The cases ideally fulfil the characteristics of a "most similar" research design (Yin 2009:50ff), since both developments occur simultaneously and contemporarily. Levels and units of analysis are the whole network level and a selection of the companies that are members in the interorganisational networks and their representatives.

For the study of (whole) networks, Hollstein suggests a novel way of employing qualitative data collection and analysis rather than the standardised quantitative or statistical network analytical canon of methods (2006: 11-35). Qualitative methods can deploy their interpretative power when analysing the perceptions and assessments of network members. They serve well when studying 'networking work', network developments and dynamics, and for identifying central actors and network forms. Data sources suggested are text material stemming from interviews with network experts (Meuser & Nagel 1991), conducted either in a semi-structured or narrative way, the latter of which is useful when reconstructing temporally remote events (Manger 2006: 228-230), to document analysis, and particularly press analyses (Hollstein 2006: 23-24).

An explorative approach is adequate since the study of the workings of social capital, the path-dependent developments of interorganisational networks and the empirical field under scrutiny here are rather new. Moreover, the developments are contemporary and subjects from the field should not have much difficulty in remembering events even in this fast-paced industry, because the focus of analysis is not so much on miniscule detail but rather on identifying broad structural processes and activities. Hence, semi-structured interviews are suitable for gathering data, since they allow for not following a fully grounded theory approach but rather a theoretically informed one (Flick 2007: 216). Furthermore, a press analysis is conducted in order to provide an outside perspective on the networks studied here and for data triangulation (Flick 2007: 519).

3.2 Introducing the field

Mobile communications has become one of the world's most important industries. Globally operating firms, fierce competition and technically driven innovation mark this fast-paced market environment. For instance, mobile phone manufacturer, *Nokia*, estimates 4 billion handset users for the year 2010 (Symbian Foundation 2009), whereas the frequently studied PC market (e.g. Shapiro & Varian 1999, Burgelman 2002, Dobusch 2008), pales in numbers: *Microsoft* CEO Steve Ballmer expects 1 billion users in 2010 (Kenellos 2004). The importance of mobile devices is expected to grow steadily. Analysts predict that internet access from mobile phones will exceed that from computers by the year 2013 (Gartner 2010), even earlier in developing countries.

Recent industry developments include the establishment of new technological standards for mobile data communication such as 3G (Ansari & Garud 2008) and 4G (LTE). In the midst of this technological change, the industry is currently facing the consequences of the financial crisis (Teltarif 2009). Formerly highly profitable companies such as *Intel*, *Motorola* and *Samsung* are struggling with declining revenues, probably worsened by a degree of market saturation in developed markets.

One technological development opening up big revenue potential is the ability of so-called smartphones[3] for users to install own software called 'apps'. *Apple* 'inaugurated' this new market when introducing their innovative smartphone *iPhone*. Albeit fairly new in customer attention, apps are becoming an increasingly attractive market, as indicated by the rapid growth of download numbers: 500 million in early 2009, one billion in late 2009 and already three billion downloads in January 2010 from *Apple*'s proprietary *App Store* alone (Slivka 2009, Apple 2010). This trend continues across platforms as was suggested by a reported 1 million downloads of only 30 available apps within 20 days after launching the *Palm Pre* smartphone of which only 150,000 had been sold at the time (Ricker 2009). This averages approx. 7 app downloads per phone within this short time.

[3] Smartphones are mobile phones with an operating system that provides capabilities exceeding voice and SMS communication and including PDA or even PC functionality. Features include address books, calendars, eMail clients, internet browsers, cameras, audio and video players, satellite navigation, and very often touch-screen-operated user interfaces.

The ability to run applications on mobile phones has been possible for several years on phones from e.g. *Nokia*, *SonyEricsson* or products with a *Microsoft Windows Mobile* operating system, but the *iPhone* brought this market to the industry's attention.

Apps do not work universally on all devices but on a single particular platform. These platforms are operating systems (OS) that come pre-installed on devices and cannot be changed by users. It is at this level that a real revolution is taking place: Until recently, mobile phone makers had programmed proprietary operating systems for most of their handsets or purchased licenses for e.g. *Microsoft Windows Mobile* or *Symbian OS*.

This changed in 2007 (Google 2007) when *Google*, which had previously not been involved in the industry, announced the development of the OS *android*. Aiming at establishing the *android* platform as a new market standard, *Google* founded the *Open Handset Alliance*, a strategic alliance first comprising 34, now already 71 firms, from many industries, such as handset manufacturers, semiconductor producers and software partners. The goal of this alliance is to develop and implement a free open source OS for mobile devices. With *android*'s introduction in late 2008, the market situation changed considerably. This revolution, driven by the powerful new entrant *Google*, is breaking the unwritten rules of the market through drawing on the cooperation of several industry players for the platform's realisation, marking a "rationality shift" (Koch 2008: 56) within the industry.

Market leader *Nokia* reacted to this new situation by establishing a strategic alliance at the end of 2008: the *Symbian Foundation* with over 70 members initially and over 180 members as of writing this paper. The goals of this strategic alliance are congruent with those of its competitor: to provide a royalty-free open source platform for mobile devices, albeit on the basis of the *Symbian OS*. This was originally a proprietary, license-based OS by Symbian Ltd. which was an industry consortium dominated by *Nokia*. *Nokia*'s relinquishment of this licensing revenue source is indicative of the industry's disruption which has been characterised by ZDnet experts as the "battle royale" between the two alliances (Espiner 2008).

While other platforms do exist (*Apple iPhone OS, Microsoft Windows Mobile*, *Palm/HP WebOS, RIM Blackberry*, *MeeGo, Samsung bada*), these alliances create two competing camps, each allying very important players from the industry. Both camps' strategies involve gaining a large market share in order to tap the promising apps market and to recover the loss of license fees induced by the open source approach. This development could potentially lead to the establishment of a (single) new market standard or at least trigger a so-called "format war", a fierce competition between industry groups as experienced in other prominent technology cases in the past (*VHS* vs. *Beta*, *Blu-Ray Disc* vs. *HDDVD*, etc.).

3.3 Relevance of the case to the developed framework

The mobile OS case lends itself to be studied from a path-theoretical perspective because it analyses what Arthur considers "agents choosing between technologies competing for adoption" (1989: 116) and potential market dominance. It is also of strong relevance to (inter-)organisational strategic research because it focuses on the competition of two alliances for technological market leadership directly after their foundation (Reuer, Zollo & Singh 2002: 136). Creating strategic alliances - and thereby changing the competitive environment (Gomes-Casseres 1996: 10) - is becoming increasingly important for firms, particularly in technology industries (Gulati, Nohria & Zaheer 2000: 204; Sydow, Windeler & Möllering 2004). The present case has been noted in research (Choi et al. 2007; Lin & Ye 2009) but neither from a network nor path dependence informed approach.

The outlined developments are similar to the case of *JVC* positioning its *VHS* against *Sony*'s *Beta* video system. This prominent historical example of competing strategic alliances and subsequent path dependence has been discussed even by path dependence critics (Liebowitz & Margolis 1995: 218-222) and was reproduced in the "format war" between *Blu-Ray* and *HD-DVD*. In both cases, one technical standard came to dominate the whole market, which from a path dependence point of view could be considered a lock-in to arguably (technologically or economically) inferior solutions. Additionally, it was in both cases not a typical market decision of consumers choosing a standard through preferences revealed in aggregated demand, but rather clever networking with strategically important players on part of the technology firms. This networking aspect, however, was not addressed and

further motivates studying the interorganisational networks in the mobile OS alliances. The logic of interorganisational networks determining a market standard differs from the conventional economic approach in that only the study of markets' supply side can reveal the reasons and mechanisms leading to potential lock-in.

A further difference to the video system case is that the mobile OS market has not yet become dominated by one standard. It cannot be studied retrospectively, but needs to be addressed from a contemporary perspective and treated as a "phenomenon in the making", (Garud & Karnøe 2001: 3).

Social capital is applicable to this field for two reasons: First, the two lead companies ("hub firms" Jarillo 1988: 32), *Google* and *Nokia*, cross industry borders to create the alliances and bridge structural holes (Burt's argument) between the different industries involved, e.g. semiconductors, software integrators, financial services, mobile phone manufacturers etc. This structural phenomenon would probably not have occurred without the initiative and network importance of the two hub firms *Google* and *Nokia*.

Second, once new connections are established, each alliance and particularly their hub firms rely on strategies and activities that lead to network closure (Coleman's argument). Creating strong ties in the alliance makes its members more intensely allied and focused on local search (Duysters & Lemmens 2003). Such a strategy appears necessary to enhance internal cooperation, disenable unfavourable external cooperation and ultimately may lead to locking-in alliance members to the platform. A platform gaining momentum attracts new members and makes the alliance grow further, while simultaneously trying to prevent members from leaving leads to greater market influence for that platform.

In sum, with the theories of social capital and path dependence as 'sensitising devices', elements of these should become obvious from the data if it can support the process of theory development. Social capital may be found in terms of both brokerage that bridges structural holes and as network closure. With regard to path dependence, a process unfolding over time with cumulative logics, i.e. a positive-feedback inducing social

mechanism would appear suitable, with a possibly inefficient lock-in at the end of the process.

3.4 Data and findings

The empirical categories presented in the following have been derived both from theory and inductively from the data and during the process of familiarising with the field. This process was iterative in that elements of path dependence and social capital served as rather broad deductive categories when approaching the data. The categories were extended inductively during the process of analysis and served as new categories later.

Several sources are being used for providing text material data. 16 professional individuals representing the units of analysis or experts insightfully describing them from the outside were interviewed informally or formally. The author also attended three industry conferences with many presentations which, together with notes taken during or after attendance, are treated as informal interviews for analytical purposes. Secondary data sources include reports, websites and industry analyses but mainly a press review of approx. 600 articles covering the time-frame from the emergence of the platforms until the present day. The press articles were collected from the global business press and influential IT industry online news services. The collection was aided by the *Google Alerts* service which can be used free of charge and provides automatic email updates if predefined keywords appear in the news.

The evidence is presented in tabular form and discussed more in detail in the subsequent section:

Category / subcategory	**Finding** (Source)	**Interpretation, meaning/ relevance for theory**
Brokerage and entry		
Motivation for membership	- OHA + SF: "We want to hear developments at an early stage and have influence" (interview).	- The firm entered both alliances with the aim of gaining an information advantage and influence.
New relations / access to resources	- "We have established many new relationships for cooperation" (interview). - New cooperation agreements announced (press).	- After a firm's entry to the interorganisational network, its new relations that may bridge existing structural holes mark the beginning of the events leading to increasing closure within the network. - The alliance activities result in new cooperative relationships.
Membership entrance process	- "Google carefully selects alliance members and manages information flow within" (interview). - OHA membership entrance procedure not transparent, fees unclear, application informal (web). - SF membership application process transparent on website, fees indicated, voting rights explicit (web).	- Already at the beginning of a new relation, the lead firm is using its superior (brokerage) position in the network in order to control entrance. This position creates a control/information advantage. - The lead firm appears to reserves the right to decide upon admission alone, thus effectively exercising strong admission control. - This transparency is indicative of a less controlling approach compared to the other alliance sub-case.

Development of activities		
Number of applications	- Apps available in android app store: 50,000. - Apps available in Symbian app stores: unclear because not centralised but: 6,500 daily 1.6mio downloads from Nokia's OVI app store (press, analyst reports).	- The activities in the alliances are increasing and producing output. This output indicates the fruitfulness of the cooperative relations and may thus lead to even further cooperation and thus a concentration of efforts of the members to activities within the alliance.
Number of handsets launched	- Android: increase from 0 devices at the foundation to some estimated 140 devices (including other hardware than smarthones such as Netbooks, Tablets, Blu-Ray players, SatNavs and even automobiles. Presently 100,000 handset activations per day (press). - Symbian: unknown handset number, but known to still exceed that of android, with approx. 40%+ market share and many new products announcements have been made by manufacturers of either platform (press).	- With regard to marketable products, the relations appear beneficial to the alliance members. Since the foundation of either alliance, this has spurred increases in activity. Further industries have been added by OHA's lead firm, thus bridging further structural holes between industries. Google appears to benefit from their brokerage position. - SF members have announced new products, but to a lesser extent than OHA members. This might indicate lesser success of the alliance in producing marketable output.
Number of members in the networks	- OHA: Starting with 5, now: 71 (press, web). - SF: Starting with 8, now: 181 (press, web).	- The attraction of new members to the alliances and their resulting growth in size in both cases is an indication of an increase in activities and also in relationships within the alliance, so that higher relationship density should be an expected result.

Category / subcategory	**Finding** (Source)	**Interpretation, meaning/ relevance for theory**
Number of relations within the network	- Participation in an industry event doubled from 2009 to 2010 (press). - Despite being monetarily not as lucrative as competitors, the android app store attracts an increasing amount of developers (press, interview).	- An increasing amount of developers is attracted to cooperate, thus focusing their activities on a particular platform. These relations may, together with investments and learning, reduce the alliance members' willingness to pursue other alternatives but rather draw on known relationships.
Duration of relations	- "We are looking at this with a long-term planning perspective "(interview). - We have been closely been cooperating with firm Q for some time now and expect this to continue (interview).	- Alliance membership creates new relationships that are of a lasting nature. This increases incentives for continuing membership.

Closure, steering & control		
Steering of activities	- Symbian Foundation is seeking an alliance manager (job advert, web).	Symbian is seeking to actively manage relationships within the alliance to integrate developers/software vendors strongly to enhance cooperation, enabling social capital from closure.
Normative forces	- OHA: "At the end of the day, Google decides" (interview). - SF: code contributions will be decided about by voting in the Foundation board (interview).	- Strong dependence on the lead firm. Member firms perceive this as a problematic issue, but still make the decision to accept this leadership. - the Foundation integrates a "one member, one vote" policy which allows for a 'democratic' type of power distribution.
Decision-making model	- Symbian Foundation manages code contributions to the platform through voting in the board (interview). - Code contributions to the OHA platform can de facto only be authorised by Google (interview).	- Individual members have more influence in this alliance, which may lead to increased cohesion and commitment. This would be indicated by more internal and less external ties and a lack of exits. - Google maintains its strong influence in the alliance, revealing further brokerage potential (social capital).
Regular activities and rituals	- OHA: "We meet at workshops, develop roadmaps, have annual plenary sessions and web-conferences" (interview).	- Regularity in meetings with other alliance members can create commitment to long-term relations and thus bind network members.

Fragmentation		
Recognition as problem	- "It would be a problem if projects dissociated. This is one of the biggest risks with open source projects" (interview). - Developers are experiencing fragmentation-related problems in adapting code. A website has been dedicated solely to this issue (press, web).	-The lead organisations and alliance members have recognised the importance of creating cohesion in the platform and one lead firm is utilising its position and resulting control power to achieve this. - Developers (some of which are alliance members) are seeking cohesion in order to avoid extra coding efforts on their part.

Category / subcategory	**Finding** (Source)	**Interpretation, meaning/ relevance for theory**
Avoiding fragmentation	- New platform versions will be released to tackle fragmentation (press). - Developers are jointly discussing and developing means to overcome fragmentations issues (interviews, press). - Google is actively trying to prevent their alliance from forking off (press).	- A technical solutions will be implemented to try to avoid the organisational issue of fragmentation/forking and thus lack of cohesion. - Cooperative relationships have been established to overcome the fragmentation issue. This might increase network cohesion and thus closure. - This trying to avoid forking could be interpreted as an attempt to lock-in members to the platform.
Exit / Lock-In		
To alliance	- Motorola has committed itself to only using android in the future, Samsung will use it for at least a third of its products (press). - Software application adaptation is difficult and thus resource intensive (interviews). - "The Dating Game" being played at industry conference with platforms as candidates to be 'wedded by developers (some of which are already alliance members or potential candidates for membership) (interview). - None of the alliance members have quit the alliance; all apparent exits have been M&A activities (press).	- A first organisational (and subsequent technological) lock-in of an alliance member seems to have occurred, indicating support for the bridging structural holes → closure → lock-in argument. - Might bind members to one particular alliance in the future if learning has accumulated over time through collaboration. - This game represents industry participants' recognition of the lock-in potential of their decision to join a platform since it resembles a strong bonding relationship. Presenters stated that such decisions should be made with care and reflexion. - The lack of exits may indicate that members perceive involvement as beneficial and thus stay on or cannot leave due to being locked-in.
To relations	- "Our Role? We are clearly a follower" (interview). - If we do not benefit any more, we will leave (interview).	- An alliance member is following a lead firm, which can proof problematic if that lead organisation fails or takes advantage. - A lock-in seems avoidable from that interviewee's point of view, possibly due to the strong financial power of the alliance member.
Other/ General		
	- Google has a strong reputation for successful project management (interview).	- This attracts new members, forms the initial basis for Google's social capital in the network through offering access to a set of resources (management, free operating systems, market clout)
	Improved versions of both operating systems have been released (press).	- Both alliances have seen contributions from their members to improve and extend the technological capabilities of their platform. This may attract more members and reveals continued cooperation.

Table 1: Summary of findings

4 Discussion, implications and future research

The first category 'Brokerage and entry' stems from the brokerage argument of social capital theory (Burt 2005) and refers to events and relations that bridge structural holes in newly created interorganisational networks. The data shows that several firms establish new cooperative ties upon entry into the alliances. Most importantly, the lead companies are spanning the boundaries of the industry and connect formerly unconnected firms, e.g. commercialisation consultants and developers or even integrate new industries such as game developers from the game console market, media publishers or financial service providers. These new connections bridge structural holes. Since at the beginning of the alliances' work, only the lead firms were in a position to do bridging, they today still retain a strong brokerage position in both alliances. The brokerage argument can thus be part of the integrative theoretical framework in so far as the brokerage relations constitute the small events of a path-dependent process.

'Development of activities' refers to path dependence theory. Increases in activity are to be expected if a positive-feedback mechanism is at work which can limit actors' scope of options in the long run (Sydow, Schreyögg & Koch 2009). The activities of the alliances have increased on various levels. First, their output in terms of products and apps has grown strongly. Also, the number of members in both alliances has risen, just as the number of cooperative relations. While these increases may be indicative of a positive-feedback mechanism, the mechanism often requires some interpretation in order to identify it. It lies in the following logic: The experience of (so far) beneficial cooperation relationships on part of the alliance members leads to the increase of output. This increases the positive incentives to further cooperate with other alliance members and results in more alliance activities. In turn, these activities lead to more cooperation and in the long run stronger closure, enabling more internal cooperation with partners known to be trustworthy and having a reputation to lose, should they defect an agreement. As such, cooperation may increase in a kind of virtuous cycle.

Furthermore, path dependence theory contains an element of stability that occurs in spite of external turbulence (Koch 2008). While the market environment proves turbulent, as

revealed e.g. in the recent unexpected acquisition of *Palm* by *HP* (Laube 2010), a certain element of stability can be found with regard to the alliances. It shows in the duration of the relationships, in the continued existence of the alliances, the regular meetings and workshops and the steady, uninterrupted growth of output. In contrast to Koch's (2008) argument, the stability here has not yet proven to be problematic. The interviewees, however, indicate a clear orientation towards establishing long-term relations which is a required element for the temporal linking of a path-dependent process.

While there are strong similarities between the two sub-cases, there are differences, too. The category 'Closure, steering & control' reveals differences that mainly concern the way of governing alliance activities and member entrance. The alliances differ strongly with regard to their application procedure. The *Symbian Foundation* allows the application of any individual or company for membership, has pre-determined annual fees and voting rights for participating in decision-making procedures (one member, one vote). The *Open Handset Alliance* differently invites the application of members by email but does not offer transparency about the admission process. The data reveal that the *OHA*'s lead firm is quite selective about who may join. The same appears true for the management of contributions to the code. While the *SF* decides 'democratically' through votes in a board, the *OHA* has the lead firm make the decisions in a more 'autocratic' way.

'Fragmentation' is a fully inductive category that arose during data collection. Interviewees perceive problems caused by differing platform code versions in different handsets and the resulting extra coding efforts that bind much extra resources. They frequently mention the same with regard to the entire market. When talking to experts, they attribute this to a lack of cohesion. Alliance cohesion, resulting in. everyone working with the same version and increasing compatibility is seen as a solution to overcome fragmentation. This is being discussed mainly from a cognitive point of view but may also be reflected in resulting structural cohesion through the interplay of the three dimensions of social capital (Maurer & Ebers 2006), because a strong sense of belonging together may lead to further cooperation. In network terminology this may be called high density, working towards network closure. Pursuing such a strategy thus results in social capital from closure.

While the findings bear indications that both types of social capital are active in the alliances and that they connect in a temporal order one after another, the current data does not unambiguously support the concept of a lock-in. One firm has exclusively limited itself to one platform and that restriction would be problematic if the platform ceased to exist. However, speaking of an inefficient network lock-in of firms at this stage would over-stretch the data's explanatory power. The lack of support for the lock-in may be partly owed to the fact that the firms interviewed so far are in a financially apt position to cope with losing the resources they invested into alliance activities. One firm even declared that it will quit an alliance if it considers membership no longer beneficial. This situation might be different for smaller companies, whose financial power is not strong and a network lock-in together with switching costs may inhibit exit from the strategic network. The market deciding against the platform they are supporting would be strategically inefficient since it would render useless their investments and knowledge accumulated in the relationships.

While neither the technical capabilities nor the market success are the focus of evaluation, it is clear that a lock-in would be at least strategically inefficient (Sydow, Schreyögg & Koch 2009). It would limit the scope of options for alliance members and bind them to a platform. With learning and investments made into the corresponding technology, a decline of the platform would likely affect at least smaller or more specialised companies, possibly causing financial difficulties. Thus members are eager to spur the market success of their platform through supportive cooperation even in the case of technological inferiority compared to other (new) platforms. This may result in a lock-in at a strategic level and network level.

The findings of this study at least partly support the theoretical framework suggested above. Thus, the standard view that interorganisational networks are per se flexible needs to be re-assessed. For theoretical research this means that while networks exert positive effects, attention needs to be paid to the turning points when positive effects entail a vicious cycle. More investigation should focus on social capital as a driver of path dependence. For management practitioners, knowing that depending on certain cooperation partners may entail a network lock-in might imply the avoidance of such a potentially negative situation if possible. Hence, dealing with the network situation in a reflected way, harvesting fruits of

collaboration while monitoring risks of overembeddedness, appears suitable for activities in interorganisational networks.

One limitation of this study is that mainly a press analysis and several interviews serve as the basis for the illustration of theoretical arguments. Further data gathered from formal semi-structured interviews and conference documents will be analysed in order to provide additional evidence. In a next step, the analysis of the collected text material shall be undertaken as consensual coding for content analysis (Schmidt 2007: 453), because it offers advantages such as measuring inter-coder reliability (Mayring 2007: 471) and can improve the interpretative accuracy of the researchers involved.

The final stage of the path-dependent process could not be shown empirically. An inefficient lock-in has not occurred yet and it is questionable whether this will actually happen in the future. Implementing a computer-simulation model that accommodates the theory outlined above and sheds more light on whether or not a network lock-in can occur through a social capital process over time will clarify this issue.

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