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Research Paper

Path Dependence of Power Relations, Path-Breaking Change and Technological Adaptation

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ABSTRACT We study the path dependence of technological systems and power relations inside companies. While the existing literature suggests power relations and technology to be path dependent and influenced by each other, interactions across these evolutionary processes remain poorly understood. We studied the history of four retail firms over 40 years, applying event structure analysis to explicate key dynamics. Companies exhibited two episodes of converging path dependency, where power relations further increased technological inertia. In each case, power initially concentrated outside the central headquarters. Path-breaking change led all firms to centralize power and implement networked IT systems supporting central control. We discuss the ability of converging technological and organizational path dependencies to create competitive disadvantage. New widely available technological innovations can disadvantage a firm vis-á-vis its competitors when the firm's established power structure prevents it from fully exploiting the innovation, and the path dependence of power relations prevents adaptation. Thus, company owners should create path-breaking disruptions in power relations when technological adoption provides value.

KEY WORDS: Organizational power, information technology, retail industry, computers, path dependence, historical analysis, event structure analysis, ESA

Introduction

The development of increasingly sophisticated information technology (IT) systems has brought revolutionary change to the global retail industry. Mass retailers emerged in the USA in the 1880s after a new national railway system enabled the cost-effective transport of goods in high quantities across the nation (Chandler, 1977; Savitt, 1999). The principal retail strategy remained relatively intact for nearly 100 years, until the adaptation of IT into the retailers' supply chain processes in the mid-1980s (Cortada, 2004). IT has played a major

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role in retail industry success stories, most prominently Wal-Mart. IT systems have improved productivity and performance (Ellram *et al.*, 1989; Reardon *et al.*, 1996; Broadbent *et al.*, 1999; Brown *et al.*, 2005) and created significant changes in business processes and strategy (Malone, 2003; Cortada, 2004; Lamberg and Tikkanen, 2006). Despite their central role, IT systems should not provide sustainable advantage or disadvantage to any firms, since investments can be easily imitated by competitors. Specialized IT service providers offer equal access to technology for all retail organizations with sufficient financial resources; even the leading adopters of IT have meager internal development capabilities. In practice, however, retail organizations have significant differences in IT adoption—a puzzling observation from a strategic perspective.

To explain the inability of some retailers to timely implement efficiency-improving technologies, we turn to the literature on path dependence—one of the most central theories of organizational and industry-level evolution (for reviews, see Sydow *et al.*, 2009; Vergne and Durand, 2010). Path-dependence studies elaborate the ability of initial technological choices made by organizations to influence future choices through self-reinforcement, lock-in and increasing returns (Puffert, 2002; Page, 2006; Cecere, 2009). We complement this literature with an added focus on the power relations within organizations.

While initial work on path dependence tended to ignore power and politics, the research on path creation (Garud *et al.*, 2010) has highlighted the importance of social and political dynamics in the emergence of technological change (Vanloqueren and Baret, 2009; Gruber, 2010) as well as technological change as a catalyst of social and political change in fields and organizations (Reinstaller and Holzl, 2009; McGuire *et al.*, 2010). Powerful organizational actors may use their influence in decision-making to direct technological changes to serve their own interests. Conversely, technological change alters the power relationships between different interest groups in organizations (Barley, 1986).

We contribute to the path-dependence literature by examining how technological systems and power structures co-evolve over an extended time period. The dilemma we address is this: if both intra-organizational power structures and path-dependent technological developments shape the technologies organizations use, how do these two forces interact? Building on a range of studies that show how power structures influence the adoption and use of IT (Jasperson *et al.*, 2002), we compare the intra-organizational power structures within four organizations. We address three research questions: *(1) Are there generic patterns of interactions between the evolutionary paths of technology and power relationships? (2) What is the role of path-breaking change and path creation in the parallel processes of path dependency in power relations and technology? (3) Do systemic interactions between the evolution of power structures and technologies explain organizational competitiveness within an industry context?*

To study these potentially complex social dynamics, we adopt a historical research design that earlier literature has identified as a potentially useful yet under-used research strategy to approach complex causalities and evolutionary processes over time (cf. Savitt, 2002; Blundel, 2006; Capoccia and Kelemen, 2007). Specifically, we study four organizations in the Finnish retail industry between the years 1959 and 2005 and their disparate ability to implement broadly available technologies developed outside Finland and offered by impartial global IT providers. We analyze our data using event structure analysis (ESA) and the ETHNO program.

Our study also has implications concerning the role organizational power relations have on the adaptability and therefore competitiveness of firms. When existing power relations are strongly path dependent and inhibit the adoption of new technological systems, the company is likely to continue operating with suboptimal technological systems and therefore to suffer from competitive disadvantage. In the retail domain, the degree of centralization vs. decentralization in operations is often path dependent and difficult to change. Furthermore, as we found optimal choice between centralization and decentralization is contingent on the characteristics of the most efficient technological systems available at the time, differences in centralization explained significant differences in the ability of companies to adopt generic technological advances.

Path Dependence of Technology and Power

Our conceptual framework, presented in Figure 1, consists of three elements: (1) intra-organizational power relations, (2) technological systems, and (3) path dependence in technology and power structures. The power relations and technological systems represent two interrelated elements within the organizational structure, whereas path dependence represents the process dynamics that guide subsequent changes. In the following, we provide a review and a definitional discussion regarding the framework. While path-dependence literature has historically addressed a number of analytical levels, including industries and even societies, our purpose is to examine organization-level path-dependent processes. We begin with an overview of path dependence as a dynamic process influenced by prior conditions, develop an overview of path dependence in power relations, and finally explicate the linkages across technological systems and power relations.

Path Dependence

Following the classic work of David (1986), Puffert (2002) defined path dependence as the dependence of subsequent outcomes on the path of previous outcomes. Path dependence means that the sequence of choices made on the basis of transitory conditions persists long after those conditions change (Page, 2006). We qualify processes to be path dependent

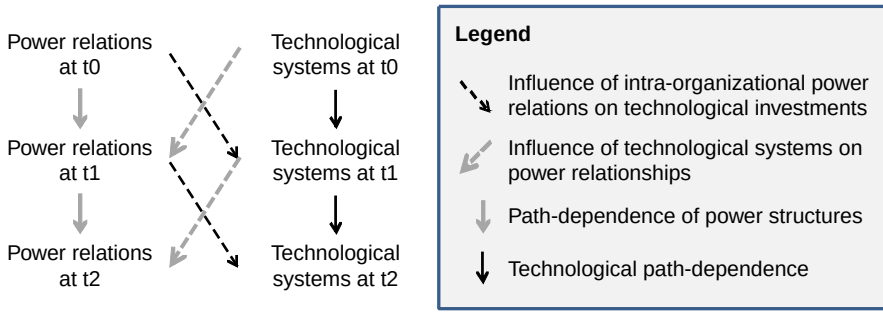

Figure 1. A summary of the interdependent evolutionary paths of organizational power relations and technological capabilities

when prior choices increase the likelihood that managers will make similar choices in the future (similar in some systematic dimension, not necessary exactly similar). Notably, we do not require initial choices to be accidental or "contingent" for a process to count as path dependent (cf. Vergne and Durand, 2010).

The idea of multiple divergent paths in organizational evolution traces back (at least) to the writing of Veblen (1915), who explained the relative decline of English manufacturing advantage in the early twentieth century as a result of first-comer disadvantage. The early adoption locked England into suboptimal technologies, allowing Germany to benefit from bypassing early and less efficient technologies. This bifacial nature of technological choice has largely remained in the focus of evolutionary research in organization theory. On the one hand, the adaptation and continuous use of a system generate capabilities (Teece *et al.*, 1997; Kenney and von Burg, 1999) and routines (Nelson and Winter, 1982) that incrementally improve the use of the specific system. On the other hand, large investments in the system make it increasingly difficult to conduct radical change, eventually resulting in relative inefficiency and decline (see, e.g. Tripsas and Gavetti, 2000). Thus, even when technological choices are initially subject to rational decisions and political processes (Pettigrew, 1973; North, 1990), they may have irreversible implications for organizational evolution.

Technological path dependence inside organizations can be triggered by a number of processes. For example, invested capital in equipment (cf. Hannan and Freeman, 1984) and compatibility across technologies that cause existing technologies to influence the pay-off from future technological choices (e.g. Murmann and Frenken, 2006) can lead companies to choose technologies similar to their initial choice. Some technologies can become critically interrelated to organizational processes to the extent that the cost of changing processes prohibits removing or modifying the technologies (Reinstaller and Holzl, 2009; Vanloqueren and Baret, 2009). Firms often continue to use a certain technology because the sunk costs for the technology prevent any short-term change and because capabilities to utilize the technology have grown over time (Heffernan, 2003; Lamberg and Tikkanen, 2006). Alternatively, myopia and ignorance can lead to bounded rationality that ignores alternative technologies. For example, Polaroid's top management failed to recognize a need to change the company's strategic focus mainly due to a cognitive narrowness and misinterpretation of pay-offs resulting from their focus on digital imaging (Tripsas and Gavetti, 2000). Whenever technology has increasing returns to adoption (Arthur, 1989), initially more popular technologies can become significantly more valuable over time—both on the societal and organizational levels.

Power Relations and Path Dependence

Organizational scholars have approached power from a variety of perspectives, ranging from the rationalistic resource-dependence perspective to critical discursive formulations (Salancik and Pfeffer, 1974; Hardy and Clegg, 1996; Hardy and Phillips, 2002). In this study, we will focus on zero-sum power relations across different organizational parties that influence organizational decision-making, commonly known in sociological literature as "domination" (Lukes, 1974; Giddens, 1984). To theorize the path dependence of power relations, we first explicate the primary forms and sources of power and then track how existing power relations may influence these sources through positive or negative feedback loops (cf. Pierson, 2000).

Political theory has recognized that positions of political authority can exhibit path-dependent increasing returns (Pierson, 2000). Once a party obtains a privileged position in formal decision-making, it can force decisions that further improve its authority. Similarly, the topic is indirectly addressed in sociological work on processes through which structural sources of power are sustained and reproduced through cultural distinctions and related signification processes that embody certain social positions with status and authority on the societal level (Bourdieu, 1977; Giddens, 1984). In contrast to such macro-level processes, our interest in this paper lies in the reproduction and accumulation of power within organizations.

Organizational power relations exhibit path dependence to the extent that the parties involved can use the available sources of power to accumulate or increase their power over another party. History matters in the evolution of power structures when the control of key resources, information, expertise or a formal position in decision-making allows an interest group to influence decision-making in ways that provide them with more control over resources, increased reliance on their expertise, beneficial information or an attractive position in decision-making processes. Such path-dependent effects can exist both within and across individual sources of power. For example, an interest group may be able to use its powerful position in intra-organizational networks (Ibarra, 1993) to secure control over critical resources (Salancik and Pfeffer, 1974), thereby accumulating even more power. Given the multiple alternative sources of power that may exist, it seems impossible to formulate a detailed account of distinct power sources (Clegg *et al.*, 2006). There is no theoretical reason to expect salient sources of power to be similar across individual firms, industries and/or societies, thus highlighting the path dependence of power as an area for empirical research.

Interdependent Evolution of Technology and Power Relations

The history-dependent evolutionary paths of organizational power relations and technological systems may be considered as two distinct dynamics within organizational evolution. Another option is to focus on how these two dynamics interact. Earlier studies have documented how technological systems can provide certain actors with power over others (Barley, 1986) and how, in reverse, actors with the power to influence technology-related decisions will make these decisions to their own advantage (Vanloqueren and Baret, 2009; McGuire *et al.*, 2010). The range of possible interaction between changing technological systems and power relations is nearly limitless. When technological change influences the frequency or content of interactions across two interest groups (or common third parties), the power relations among these groups in question may also change. Yet, the path dependence in power relations, either within or across organizations, has been largely overlooked in the field of organization studies, even though political processes have important ramifications on the evolution of organizations and technology (Garud and Rappa, 1994).

Such bidirectional relationships between technology and power have been examined most extensively in the literature related to IT (Jasperson *et al.*, 2002). Commonly, new IT systems influence power relations by changing the distribution of information (Lee, 1991). IT systems typically facilitate the collection and distribution of information within and across interest groups, such as within the different actors of the supply chain in the retail industry. Such

information flows may empower parties who could not previously act because they lacked access to information, but it may equally facilitate more effective hierarchical control (Zuboff, 1988; Jasperson *et al.*, 2002). By increasing information flow, new technologies may eliminate the ability of certain stakeholders to influence decision-making by withholding information.

Given that technological investments, such as large-scale computer installations, threaten the status and position of individuals and departments (Pettigrew, 1973), actors are likely to leverage their power relations to facilitate or hinder technological adaptation. Akin to technological path dependence, differences in political authority and power can persist over time as a result of their initial conditions, the accumulation of institutional sources of decision-making power and an increasingly inert web of social commitments (Pierson, 2000).

Studies show that sensitivity to the power-related outcomes of IT initiatives leads to the promotion of (and resistance to) new IT investments. Recognizing such risks, powerful actors are likely to leverage their power relationships to facilitate or resist IT investments (Franz and Robey, 1984). In the IT domain, the concerns of potential changes in power positions influence the entire IT life cycle, including technology-related decision-making, the design of the technological systems, the implementation of the technologies and the subsequent utilization of the technology within the organization (Zuboff, 1988; Weill and Olson, 1989; Robey, 1997).

Path-Breaking Change and Path Creation

The interaction between technology and power is central in research focused on path-breaking changes and path creation. Rather than conceiving path dependence to be triggered by random initial conditions, this literature directs our attention to the identification of the sources and decision-making processes that initially cause path dependence and to the potential shocks that "break" developmental paths (Garud and Karnoe, 2003). The literature suggests a concept of "path creation" as a micro-level explanation for the initial emergence of developmental paths emphasizing individual intentional actions, but does not deny the explanatory power of path dependence as a non-intentional process that unfolds over time. The "creation" of a new path can also mean the "breaking" of an existing path.

Path dependence and path breaking/creation eventually represent theories from two different scientific paradigms. Path dependence is a structural explanation of how and why historical processes determine the range of alternatives. Path creation, on the other hand, emphasizes how individuals and organizations are embedded in processes fundamentally influencing the direction and speed of technological and organizational development paths (Garud and Karnoe, 2003). Path creation is a process that happens due to the intentional and creative activities of individuals using path-dependent processes as platforms of innovation (Thrane *et al.*, 2010). From this vantage point, our study of interrelated path-dependent processes concerning technology and power relations enables us to better conceptualize the relationship between structural determinism (path dependence) and organizational innovation (path creation) (cf. Schreyogg and Sydow, 2010).

Summary

Our literature review elaborates intra-organizational path dependence within technologies and power structures and suggests an abundance of potent interactions among the two.

If these interactions are truly ubiquitous, the attention to mutual evolution of power and technology calls into question whether prior research has too single-mindedly focused on technological sources of path dependence. Thus, it is worth examining whether the omission of power relations has distorted our understanding of technological path dependencies in organizations. The added focus on power can also contribute to the better understanding of path-breaking changes within organizations. Power relations [technology] could either enable or inhibit the ability of agents to induce "breaks" into technological development [changes in power relations].

In our analysis, we set out to answer the following three questions: (1) Are there generic patterns of interactions between the evolutionary paths of technology and power relationships? (2) What is the role of path-breaking change and path creation in the parallel processes of path dependency in power relations and technology? (3) Do systemic interactions between the evolution of power structures and technologies explain organizational competitiveness within an industry context?

Method and Data

Research Context

The study focuses on the four dominant retail organizations in Finland from the day computers were first introduced in the retail industry (November 1959) to 2005. For the entire period, the four retailers we examined, Kesko, OTK, S Group and TUKO,[2] had a combined market share of over 90 per cent of the Finnish grocery business (Hjerppe, 1989; Skurnik, 2002). Studying the four retail organizations enabled us to cover the co-evolution of IT and power relations in one specific industry during the entire lifetime of its IT implementation. The retail groups provide an ideal research setting, as they exhibit substantial differences in both power structures and technological choices. Yet, the retailers were comparable in terms of their core activities and environment, helping us draw inferences. We were thus able to conduct comparative analyses on the similarities and discrepancies in the evolutionary paths of IT and power relationships.

This story of retail oligopoly is particularly interesting for the differences in the ideology and power structures of these four organizations, persisting from their very founding up to the 1990s. The S Group and OTK originated from an association of local co-operatives, which was split in two in 1917. OTK followed a socialist ideology, while the S Group followed a peasant/agrarian ideology. TUKO and Kesko, in contrast, were founded later, during a period of war with the Soviet Union (1939–44). The purpose of TUKO and Kesko was to further the interests of independent wholesalers and retailers during the wartime rationing system. While Kesko was owned by individual retailers and their representative association, TUKO was owned by local wholesale companies.

During the first decades of our study, Finnish society went through a radical transformation, including extensive urbanization, increasing income levels and a rapid

[2] TUKO = Tukkukauppojen Oy, Kesko = Kauppiaitten Keskuskunta r.l. osuuskunta, S Group = Cooperative enterprises and Suomen Osuuskauppojen Keskuskunta (SOK) with its subsidiaries. The organization we call "OTK" (standing for "Osuustukkukauppa") was officially called OTK from 1918 to 1982, then EKA from 1983 to 1994 and finally Tradeka from 1994 to 2005.

growth in private automobiles. Respectively, retailers started to shift from small-scale rural general stores to deploying suburban self-service stores. This also meant that the Finnish retail market was open to conquest, resulting in major changes in the competitive positions of the retailers. Another critical period impacting the competitive situation of the retailers was the major depression Finland went through in 1990–93, during which the gross national product decreased by 13 per cent and unemployment rocketed from 3.5 to 18.9 per cent (Honkapohja *et al.*, 1999). This depression accelerated the restructuring processes of Finnish retailers and paved the way for another redistribution of market shares. The development of relative market shares over the study period is plotted in Figure 2. The key historical developments per each retail organization are summarized in Table 1.

Data Collection

We started our research by collecting historical studies on IT in the Finnish retail sector (Tienari, 1993; Manninen, 2003). We continued by gathering company histories (Hoffman, 1983, 1990; Kallenautio, 1992; Herranen, 2004), published academic studies (Lehti, 1990; Mitronen, 2001; Skurnik, 2002; Lamberg and Tikkanen, 2006), annual reports, newspaper articles, industry studies and press releases. Specifically, we used annual reports of the four organizations to identify discreet decisions and strategy statements. These provided us with an in-depth understanding of the relative power positions of various constituencies within the organizations and the generic patterns of organizational change. The choice of historical setting enabled us to convince all four companies to grant us access to their extensive internal archives.

Along the process, we interviewed altogether nine IT professionals who had made significant careers in the IT departments of the case organizations. Our informants had held

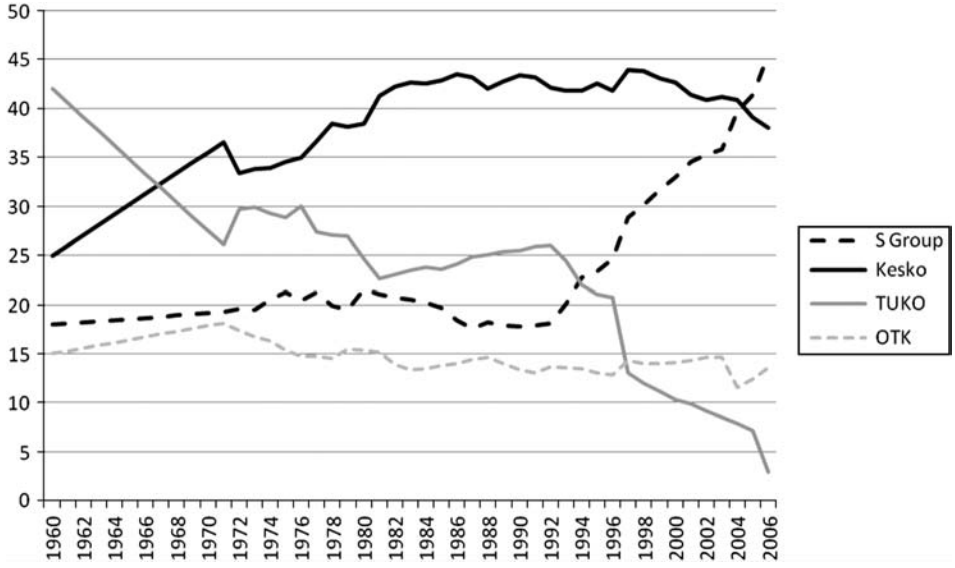

Figure 2. Relative market share of the retail groups 1960–2006, percentages

Table 1. Key historical events in Finnish retail organizations

Organization	Traditional power structure	Path-breaking change	First adoption of IT	The impact of path-breaking change on IT
OTK	Power diluted to two partly competing central organizations and numerous local co-operatives.	After financial and operational crisis, the majority of local co-operatives merged to form the national EKA organization in 1983.	The history of IT in Finnish retail began in November 1959 when OTK, or more precisely one of OTK's constituent local co-operatives, Elanto, received its first computer.	EKA started to build common POS systems within different store concepts in the mid-1980s, the merger also started the renewal of all major operational IT systems.
S Group	Power diluted to local co-operatives, and manufacturing industries controlled by the central organization.	Quite similar to OTK, over 180 small S Group co-operatives merged to form 39 larger units in 1984. This enabled S Group to launch radical rationalization and renewal processes.	The second adopter of digital computers in Finnish retail, ordered its first computer in 1960–61	S Group created a completely new IT strategy in 1988 that led to the replacing of all the major operational IT systems with new chain management IT systems (including POS)
TUKO	Power held by local wholesale companies that effectively prevented or slowed the central organization implementing strategic changes.	A number of TUKO's wholesaler-owners drifted into economic difficulties during the 1980s and were acquired by the increasingly indebted TUKO. In the early 1990s, TUKO became a victim of financial speculation. In 1996, TUKO was sold to Kesko and then parceled into several smaller companies.	A late adopter in computing, did not acquire a computer until 1974. However, started using digital computing on an outsourcing basis in the mid-1960s.	Deployment of common POS system started in 1985. The restructuring in the early 1990s did not lead to major changes in IT development, many of the critical IT systems were already built during 1980s.
Kesko	Kesko's central organization functioned to serve independent retailer-owners. This worked well until the interests of the entire group and individual retailers increasingly separated in the 1990s.	In the late 1990s, the integration of two separate stock series diminished the voting power of retailers. This allowed the central organization to take control of operations such as chain management, buying and inventory management.	Had their first computer system up and running in the spring of 1964.	Kesko was not able to build IT systems to support chain management operations until the late 1990s, when it built a new ERP solution and deployed common POS systems.

different positions in the IT departments; many had started as programmers in the 1960s and were now IT managers and CIOs; some were already retired. The interviews were semi-structured and lasted between 1.5 and 2.5 hours. The interviews were taped and transcribed. We also had several follow-up discussions and email correspondence to complete and verify our data. We complemented our interviews of retail staff by independent industry experts; one interviewee had acted as an IBM account director for the retail industry in Finland in the 1960s and 1970s. Our data gathering was complemented with multiple informal discussions with other non-IT-related executives from the case organizations.

Overall, our data collection process resulted in extensive material that allowed us to make inferences from multiple vantage points (cf. Capoccia and Kelemen, 2007; Scheffer, 2007). The internal archival material enabled us to triangulate and complement the knowledge gathered from other sources. Particularly, as annual reports can suffer from conscious efforts to portray overly positive impressions and retrospective interviews suffer from a variety of potential biases, the ability to verify our initial interpretations from historical documents was extremely valuable.

Since no reliable accounts of the IT systems within the Finnish retail business existed, we began our historical study by composing 10–15 page historical accounts for all four case organizations. We specifically focused on how and when the retailers applied new information systems in their business, with a lesser focus on the properties of the underlying technology (Cortada, 2004; Yates, 2005). The histories covered the entire computer era in all four organizations, starting from the introduction of their first computers in the late 1950s, continuing to the deployment of automatic replenishment applications and voice-directed warehouse systems in the mid-2000s. We asked our key informants to read these histories and revised them based on their feedback.

Event Structure Analysis

After collecting historical facts related to the industry and its environmental dynamics, we conducted event structure analysis (ESA) between the four organizations to explicate the path-dependent processes taking place in the organizations (Heise, 1989). ESA offers a systematic, computer-assisted procedure to model causal relationships across observed events (Corsaro and Heise, 1990; Brown, 2000). Concretely, we used the "ETHNO" online software to analyze the sequential event data we had extracted.[3] We screened our data to reach a set of key organizational actions and choices on technology and power structures, triangulating our sources to establish when and why these might depend on preceding technological and political factors. In accordance with Mahoney (2000) and Pierson (2000), we were interested in identifying manifestations of historical causality and influence between power relations and technological conditions over time, including path-dependent and path-breaking processes.

The ETHNO software produced the diagrams of the event sequences presented in Appendices A-D. Based on the outcome of the ETHNO analysis, we next constructed higher level descriptions of the causal histories in the organizations, also distinguishing the technological and political sequences of the events. These analytical views of the causal

[3] http://www.indiana.edu/ ~ socpsy/ESA/home.html

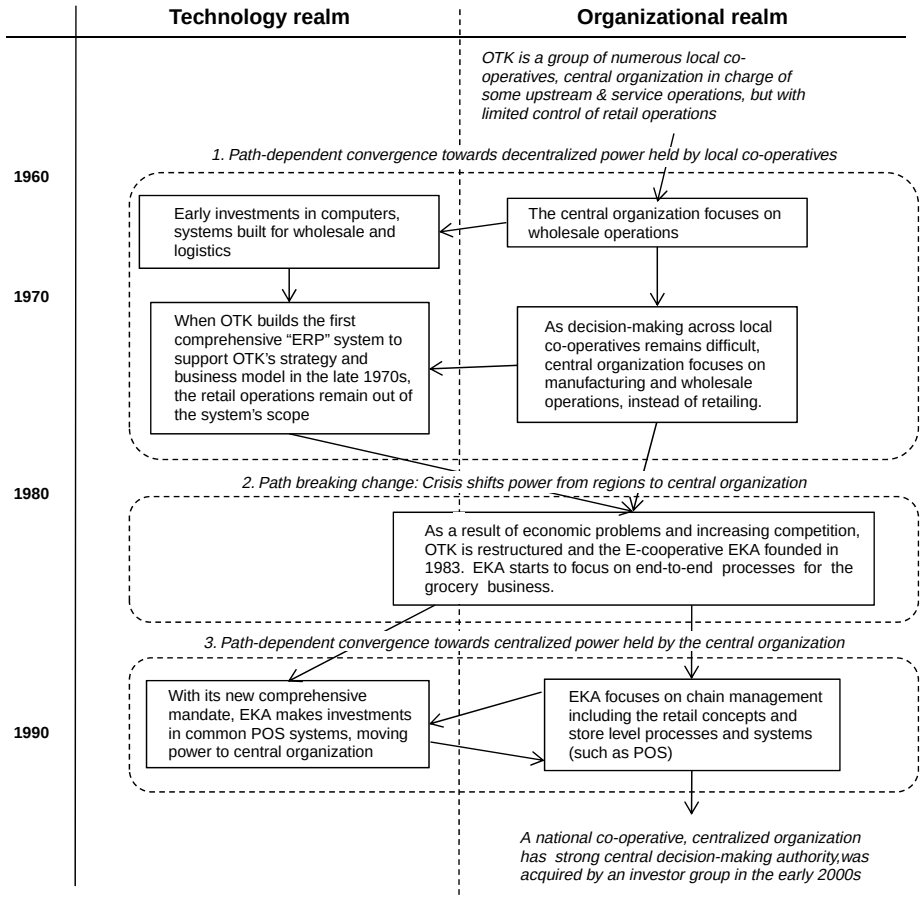

Figure 3. Analytical view of the causal sequences in OTK

sequences (see Figures 3–6) enabled us to explicate how technological and power-related factors influenced each other over time to shape the evolution of organizations (cf. Pajunen, 2005). As a final step, we compared the analyses of the four retail corporations in order to identify and understand the common characteristics and key distinctions between the intra-organizational development paths.

Findings

We first elaborate and compare the path-dependent evolution of IT applications and power relations in the four retail organizations and then examine how power relations influenced the adoption of IT systems and discuss the impact of IT systems on shifting the locus of power towards the headquarters in the four organizations. Finally, we elaborate the role of existential threats in all organizations in creating a period of path-breaking change and new path creation.

Not surprisingly, all organizations exhibited technological path dependence: investments in new technology built on prior technological investments. The continuity was

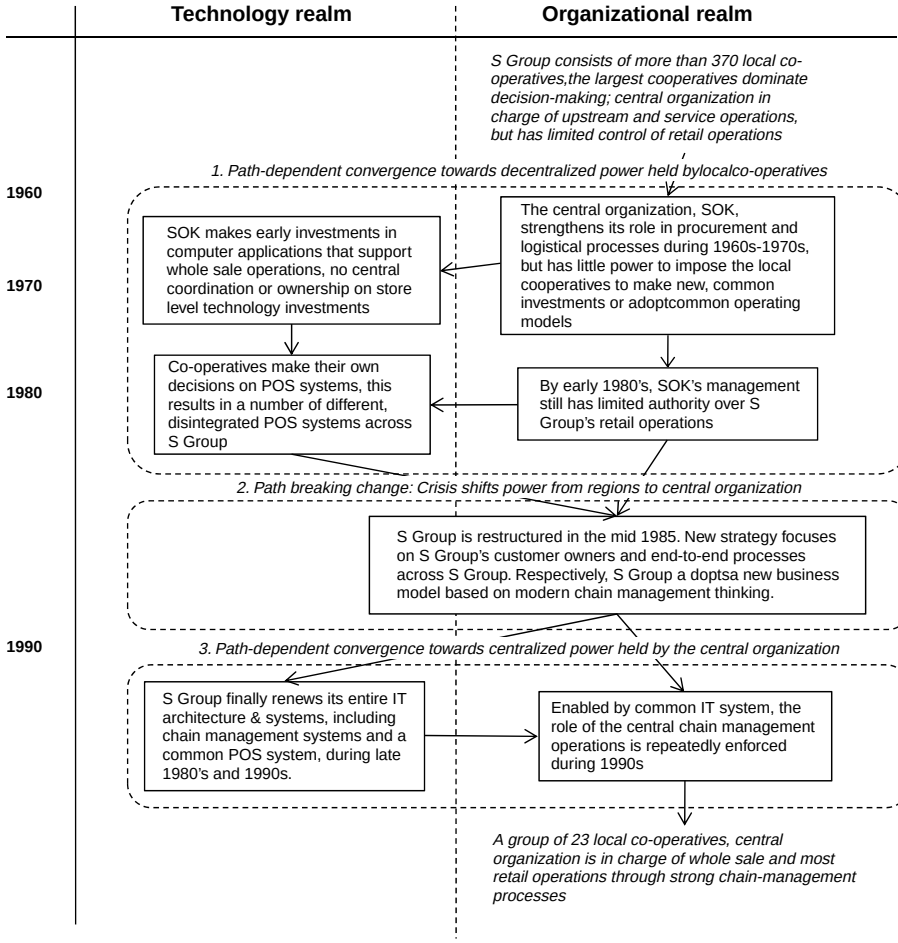

Figure 4. Analytical view of the causal sequences in S Group

strongly evident in the IT histories, although these characteristics cannot always be captured in the ESA figures. Although OTK consistently adopted novel technologies, most information systems (such as the YJ83 in Kesko, order management systems in S Group, material management systems in OTK and point of sale (POS) systems in TUKO) were used for decades. Companies were reluctant to replace existing functional systems, leading to a gradual upgrading of hardware and specific functionalities without radical changes to the main features and data structures. Significant changes in the business logic and functionality were only achieved by implementing completely new systems and even then the prior systems often strongly guided the implementation of the new systems; in OTK, some data records in 2005 originated directly from the punch-card systems of the 1950s. The divergence of the POS systems provides an example of technological path dependence also visible in ESA analysis: initial decisions to adopt heterogeneous systems at store level

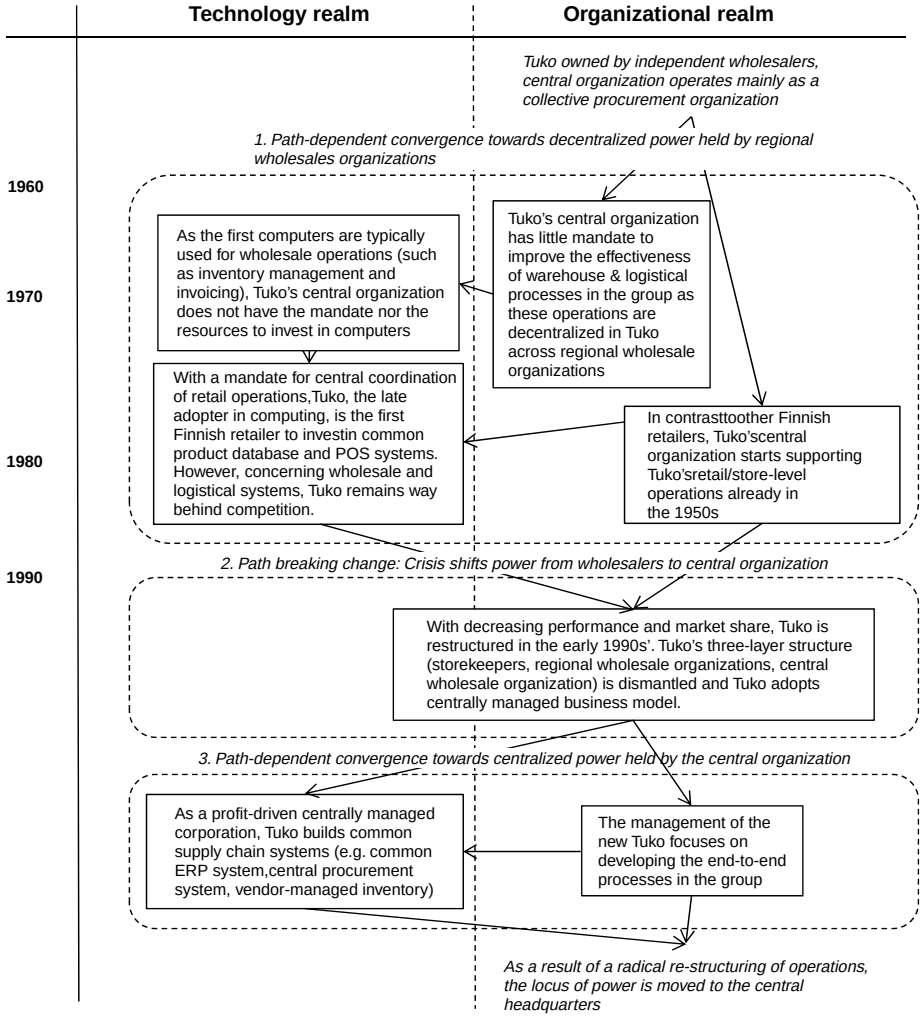

Figure 5. Analytical view of the causal sequences in TUKO

(rather than a standardized solution decided on the corporate level) led S Group and Kesko to delay investment into networked POS.

Likewise, we found considerable path dependence in the power relations among headquarters, retailers and regional wholesalers/co-operatives. The power relationships in the organization were "locked-in" by the initial conditions, most importantly the ownership structures at the founding. In all four organizations, decision-making authority over strategy, business models and investments followed closely the ownership structures. Organizational actors with powerful positions defended their interests by preventing or postponing decisions that would weaken their positions, while also seeking to consciously further strengthen their position. For example, retailers forced Kesko to decentralize advertising and assortment management in the 1980s, a move that in hindsight appeared to

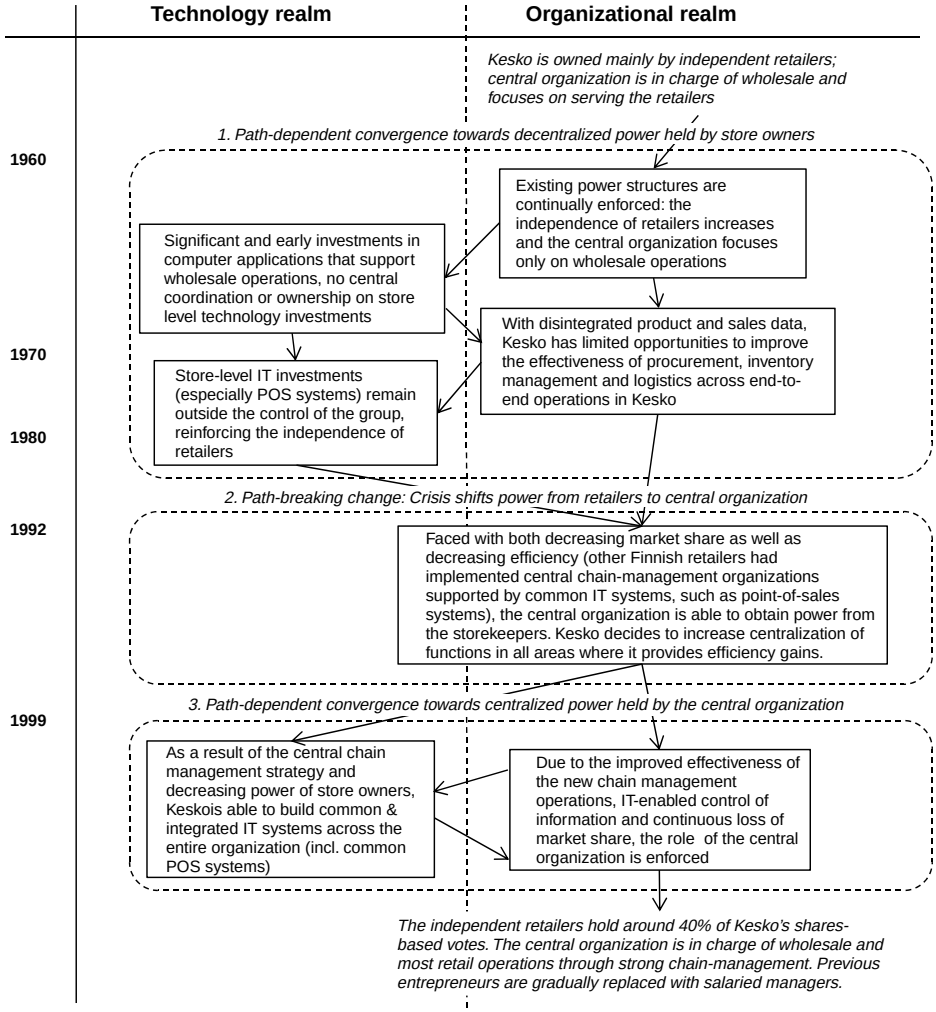

Figure 6. Analytical view of the causal sequences in Kesko

reduce overall efficiency but at the time prevented the corporate headquarters from gaining power over the retailer-entrepreneurs.

As expected, the path dependence of power and technology were interdependent. We found a striking and consistent effect of power structures on technology adoption of IT systems with political implications. At the time when the central organization had inferior power relative to the other parties (i.e. independent retailers, co-operatives and warehouse companies), there was scarce adoption of IT applications that constrained the independence of local organizations and provided information on the local operations to the central organization—even though the systems were available. The influence of power relations on technology is most apparent in the case of Kesko, which was initially the frontrunner of IT use during the 1960s and 1970s when computer systems had little impact

on the strong position of retail outlets. However, when the computers and inventory management systems entered retail stores in the 1980s, Kesko was slow to react. In particular, the retailer-owners resisted the adoption of IT systems that provided the corporate headquarters with detailed information on their retail activities, for example, the POS systems. In contrast, OTK was the only retail organization that was able to make centralized decisions about store-specific processes and operations. Lacking political resistance, OTK adopted IT which influenced the autonomy of store-level operation systems years ahead of their competitors.

The changes in technology also influenced power relations. The introduction of POS systems in the late 1970s started the digitalization of the retail stores. By the early 1990s, most Finnish retail stores had POS systems that collected detailed and accurate data on their sales. The POS systems diminished the dependence of the headquarters on the expertise of the retailers, as well as at the regional level, by increasing information flows to the headquarters. This allowed the headquarters to exert bureaucratic control over the retailers and wholesalers. With comprehensive and up-to-date sales data, the central organizations were able to take over the category planning and supply chain operations, reducing the dependency of headquarters on non-central actors and increasing the dependence of others on headquarters.

For example, in Kesko the headquarters started for the first time to consciously limit management information delivered to the individual stores in the early 2000s. This reflects the shifting power relations between the store personnel and the central organizations. As the central chain management personnel had the information and the IT systems to manage the store-level operations, the role of the store managers decreased considerably in significance. IT systems also increased standardization and central control of work processes. Common product master data, for example, helped to unify assortments and logistical processes in all the retailers. Perhaps the most dramatic changes in power positions resulted from automation that rendered previously valued human activities obsolete. Automated store replenishment, for example, redefined the role of the storekeeper in the ordering process.

Ultimately, all four organizations manifested a similar pattern of path-breaking change, caused by the lack of competitiveness and the realization that external developments in IT and business processes favored greater centralization. The path-breaking changes in the organizations reconfigured the path-dependent power relationships, representing an event of path creation that placed all firms on a path towards increasing centralization facilitated by

Table 2. Summary of research results

	OTK	S Group	TUKO	Kesko
Beginning	R/c	R/c	W	S/c
Pre-crisis	R/c	R/c	W	S
During crisis	C/r	C/r	C/w	C/s
Re-structuring	1983	1985	1992	1999
Final power configuration	C	C	C	C

Locus of power within retail groups: C = central organization; R = regional organizations; S = store owners; W = independent wholesale organizations.

the converging centralization of power and the implementation of networked technological systems that facilitated centralization.

It is noteworthy that each organization started from its unique configuration of decentralized organizational power relationships (see Table 2). Yet, each organization ended in almost identical hierarchical structures in which corporate headquarters controlled all major processes within retail chain management. In the two co-operatives (OTK and S Group), a financial and operational crisis in the late 1970s and early 1980s initially catalyzed a transfer of power towards the central organization, resulting in an almost total collapse of the regional co-operatives. As the restructuring had occurred already in the early 1980s, it simultaneously allowed the adoption of increasingly efficient IT systems, chain management strategy and related logistical processes. Consequent improvement in market performance (especially in the case of S Group) finally cemented centrally-managed hierarchical corporation as the modus operandi, with all major strategic decisions to be decided at the corporate headquarters.

TUKO embarked on a similar path towards centralization, but significantly later. Since the regional organizations were independent wholesale firms, they were able to literally refuse to (a) voluntarily re-organize (as in the case of regional co-operatives); and (b) allow TUKO to take a more central role in chain management. The power position of TUKO strengthened during the financial crisis at the end of the 1980s and early 1990s, but strong path dependence in power relations was only overcome through an intervention from major financiers, creating the consequent path of increasing centralization.

Kesko was the last to undergo a change in the fundamental power relations, exhibiting strong path dependence within power relations. As the market performance of Kesko continued to be very good until the 1990s, there was no immediate reason for path-breaking change in power relations. However, the path-dependent development of Kesko's chain management IT system lagged behind the highly efficient centralized IT solutions developed abroad and exploited by its competitors. Once Kesko's market performance started to deteriorate and the benefits of greater centralization were evident—not only from the increasingly successful S Group but from retailers globally—the power struggle between independent retailers and the central organization became more acute. These tensions were only resolved when the central organization was able to wrestle power from the retailers in part through a juridical process at the end of the 1990s. The path-breaking change and consequent path creation resulted from observed inferiority in chain management and logistics combined with an organizational crisis. The final outcome was still the same as in the other groups: a centralized power structure and intensive use of the very latest IT.

Discussion and Conclusions

Three research questions guided our historical analysis on path dependence in technology and intra-organizational power: (1) Are there generic patterns of interactions between the evolutionary paths of technology and power relationships? (2) What is the role of path-breaking change and path creation in the parallel processes of path dependency in power relations and technology? (3) Do systemic interactions between the evolution of power structures and technologies explain organizational competitiveness within an industry

context? We address these questions separately and summarize the contributions of our study to the theory in these respective areas.

Interactions across Path Dependencies of Power Relations and Technology

Path dependence is a process that takes place in a distinct pre-defined dimension, typically the choice of technology to invest in (e.g. Reinstaller and Holzl, 2009). Our study contributes to the literature by examining a novel dimension of path dependency: the degree of centralization in the organization. We found this political dimension of organizational path dependency to also explain the evolution of technology.

Our study shows that the marriage of power interests and technological systems created its own, even stronger, process of path dependence where self-reinforcing effects combine with mutual reinforcement of the evolutionary path. In all four organizations, the path dependencies converged into mutually reinforcing power structures and technological systems on two occasions: due to the initial power conditions and due to reconfiguration triggered by a path-breaking crisis. Initially, power relations acted to inhibit technological change, locking the company even more strongly into its present technological systems. After the path-breaking change, power and technology reinforced the effects of one other, leading to a convergence towards centralized power and centralized technological systems.

Path-Breaking Change and Path Creation

In contrast to the existing literature that tends to attribute path-breaking change to mindfulness (Garud and Karnoe, 2003; Thrane *et al*., 2010), our case exhibited a quite distinct dynamic. The organizations became mindful of the potential efficiency gains available from switching the path from decentralization to centralization during the 1980s, or at the latest in the early 1990s. However, the path-breaking change to a new configuration of technology and organizational power happened only through an existential crisis in each of the four case organizations.

In line with the punctuated equilibrium literature (e.g. Tushman and Anderson, 1986), organizational crises disrupted self-reinforcing paths of decentralization in power and technology. In each organization, the crisis shifted power away from the periphery towards the central organization and legitimized path-breaking changes to existing technological systems. Crisis facilitated the implementation of new technological architecture, new types of inventory systems and control technology. The initial adoptions of these IT architectures positioned the companies on a technological path to adopt further applications (cf. Tegarden *et al*., 1999). Technologies increased the dependence of retailers and regional units on the central organization, effectively creating a path for a self-reinforcing dynamic of increasingly centralized power. Reinforcing the newly created developmental path, these shifts in power relationships allowed further adoption of centralized IT systems that would have earlier been prevented by organizational politics.

In summary, our contribution to path creation lies in illustrating the role of organizational power relations in creating new techno-political paths. While the creation of technological paths involves the creation of self-reinforcing mechanisms in the domain of technological choices (Reinstaller and Holzl, 2009; Sydow *et al*., 2009), the creation of techno-political paths represented the intertwined formation of a coherent path for both power relations and technology investments. Our findings suggest that the act of technological path creation can

be simultaneously a "Machiavellian" act of political path creation—by stepping on a technological path towards a centrally coordinated IT architecture, retail groups also ensured the creation of a path towards a certain power configuration.

Path Dependencies and Competitiveness

Our study suggests that the systemic linkages between power and technology strongly affected the ways the organizations competed in the marketplace. Available developments in technology would have enabled all of the organizations to update their business models and improve their efficiency—yet, most of the groups failed to make the performance-increasing investments despite strong evidence of benefits from abroad. Should we consider technological path dependence on its own, we should expect organizations with very similar technological systems to make relatively similar investments (Vanloqueren and Baret, 2009; Gruber, 2010). In our data, organizations avoided technological advances because they conflicted with the path-dependent power relations. The initial decentralization of power relations increased the "inertia" in technological development, leading initially similar organizations to adopt external developments at a different pace.

Kesko represents an extreme case to support this argument. It was easily the most successful group in our sample, but one that became hostage to path-dependent power relationships which inhibited central management from implementing centralized networked IT systems. In contrast, OTK was an anomaly—a poorly managed company that was able to adopt superior technological systems and move towards central coordination at an early stage. However, OTK was mired by problematic stakeholders and sub-standard resources development during the period when socialist ideology dominated decision-making.

In theoretical terms, the concept of technological discontinuities helps explain how strong convergent path dependencies in technology and power relationships are likely to create problems (Tushman and Anderson, 1986). Even when companies might otherwise overcome intra-organizational technological path dependencies and adapt to a new technological paradigm, the convergence of technological path dependence with power relationships can inhibit change in the technological paradigm. Persistence with the old technological paradigm will eventually lead to a suboptimal technical performance (Perez-Nordtvedt *et al*., 2008). Over time, suboptimal performance in some technical domain will lead to higher cost structures, a lack of competitiveness, and a decrease in market share and/or profitability.

Practical Implications

The study is not without practical implications. Power structures influence the timing of IT investments, and thereby the relative competitiveness of the organizations. Our study may act as a reminder that retail organizations are not always monolithic entities in a shared ideological pursuit of efficiency. Political coalitions are likely to be conscious of their positions and will use the power available to them to reproduce and even increase their standing within the organization. For retail industry managers willing to improve efficiency and shareholder returns, technological path dependencies may well appear trivial in comparison to the pregnant path dependencies of power. Since we found power relations to prevent path creation based on mere mindfulness, the findings call attention to the need for

owners to intervene and create a path-breaking change when crucial technological adaptation is prevented by path dependency of the prevailing power relations.

Limitations and Future Research

It is important to recognize further limitations in studying power structures within the context of a single country and industry. As noted in our literature review, sources of power can vary across cultures, industries and even individual organizations. Power is often subjective, as the ability of an interest group to dominate another depends on the perceptions and attitudes of the dominated (Bourdieu, 1977). In other industries, the ideology of technological efficiency may dominate any influence of power on technological path dependence. Many modern corporations, especially in the USA, are controlled by a strict hierarchical command that extends over any decentralized decision-making power. Tight central control would preclude the resistance and politics we document. Thus, the applicability of our model seems bound to those organizations where hierarchical power can be contested.

The breadth of data and the span of historical developments covered in our study forced us to limit the material we exhibit. By opting to illustrate path-dependent processes within a national industry through a significant time period, less attention has been devoted to individual decision-making processes. While a comprehensive synthesis of data from interviews, archives and publications allow us to compare broad patterns of change in organizations, additional insights could inevitably be gained by adopting a different analytical method, undertaking a more fine-grained investigation of individual key decisions.

Our theoretical contributions inevitably raise questions concerning the development of technologies that facilitated centralization. Was the emergence of technologies that require centralized control and management structures in the USA coincidental? Did power structures at the sites of technology development influence the macro-level technological paths? In our study of technology users, the technological developments appeared "deus ex machina", as foreign inventions that made centralization more efficient than decentralization.

In summary, we would like to encourage future research to further develop the path-dependence approach to organizational power. Most contemporary studies and theories of power focus on either broad discursive structures or micro-level rhetoric practices (Clegg *et al.*, 2006). Yet, by ignoring the most basic conception of power as the rule of the dominant over the dominated (Lukes, 1974), we may miss crucial evolutionary processes that shape not only individual organizations but whole industries.

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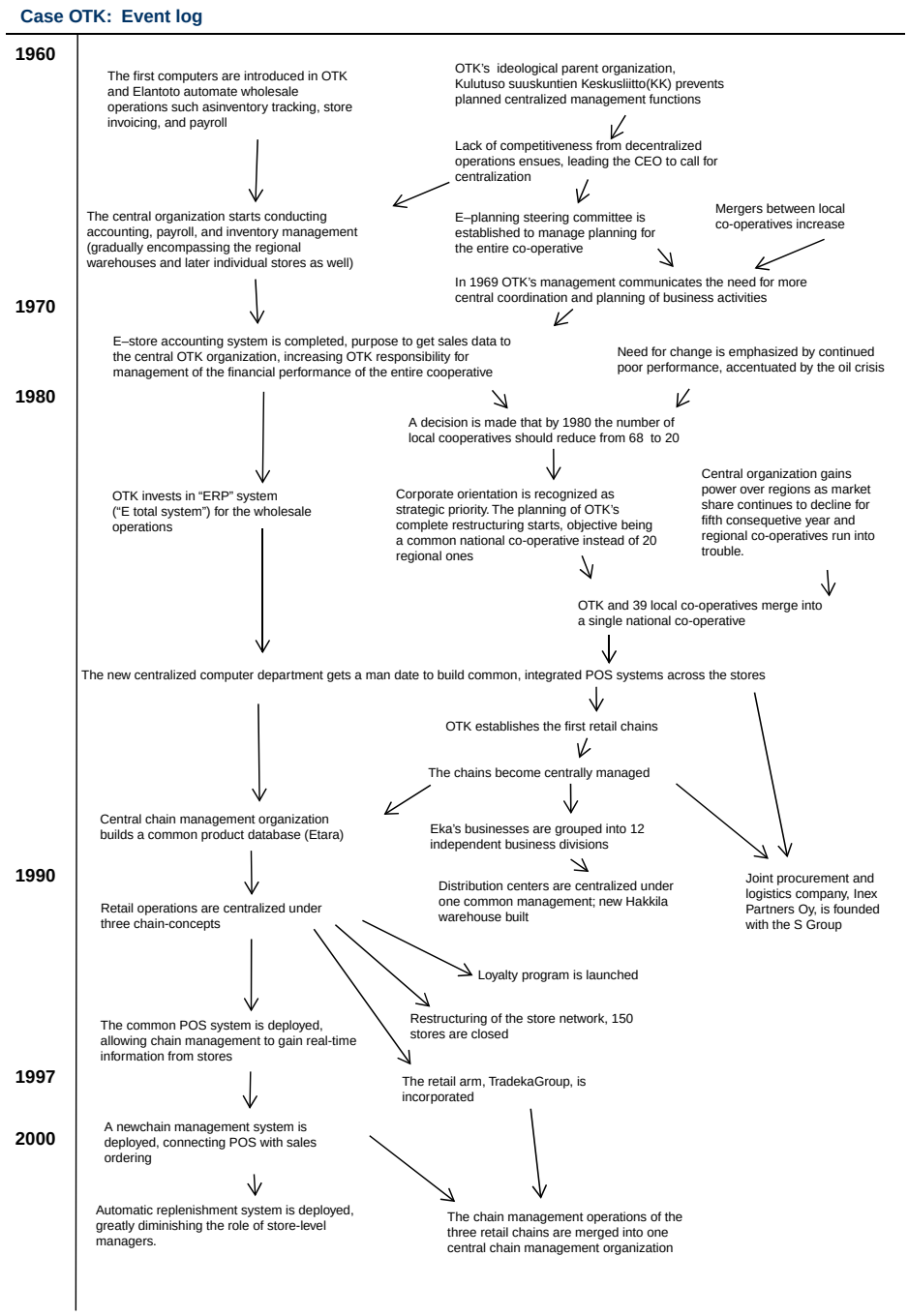
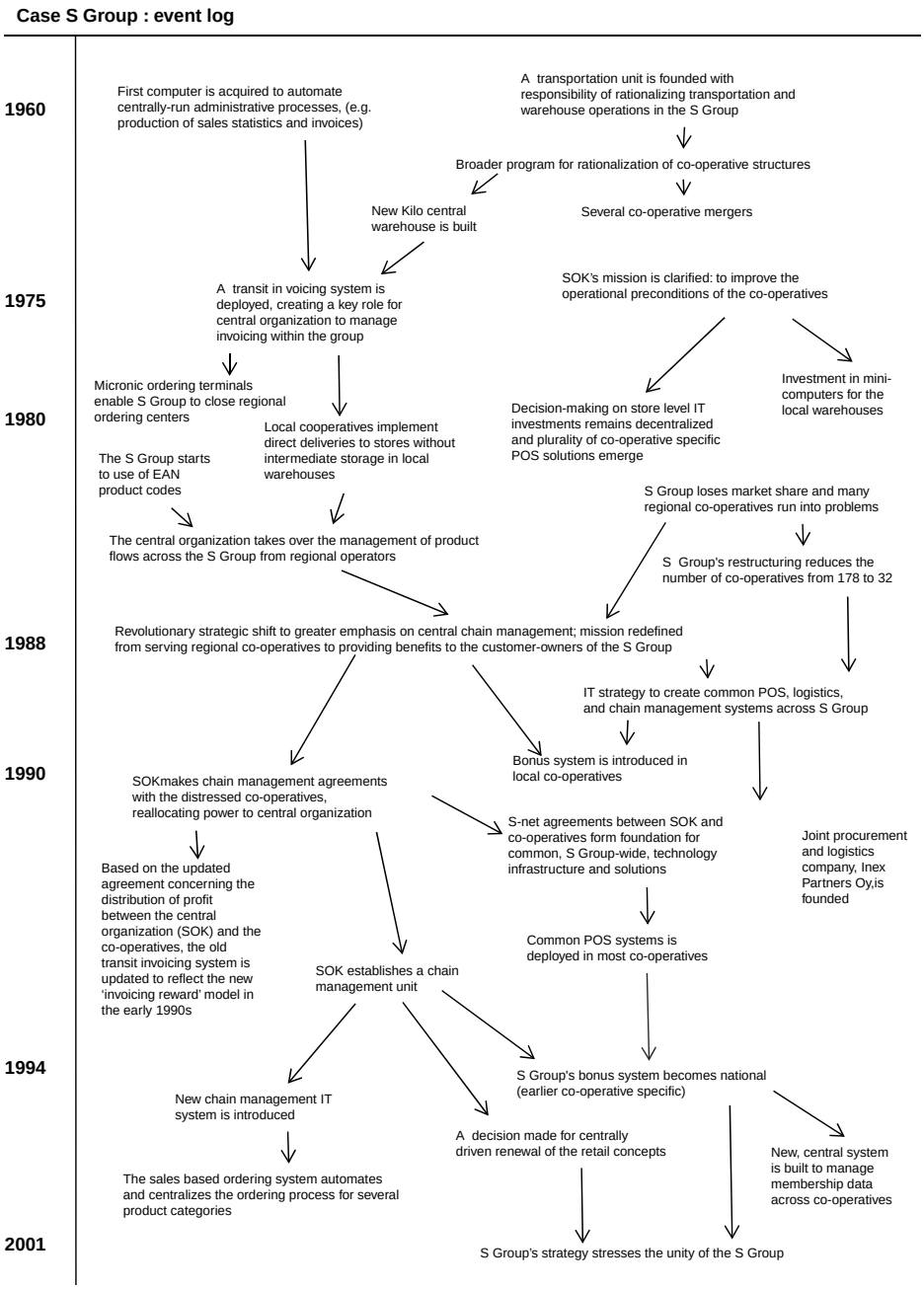
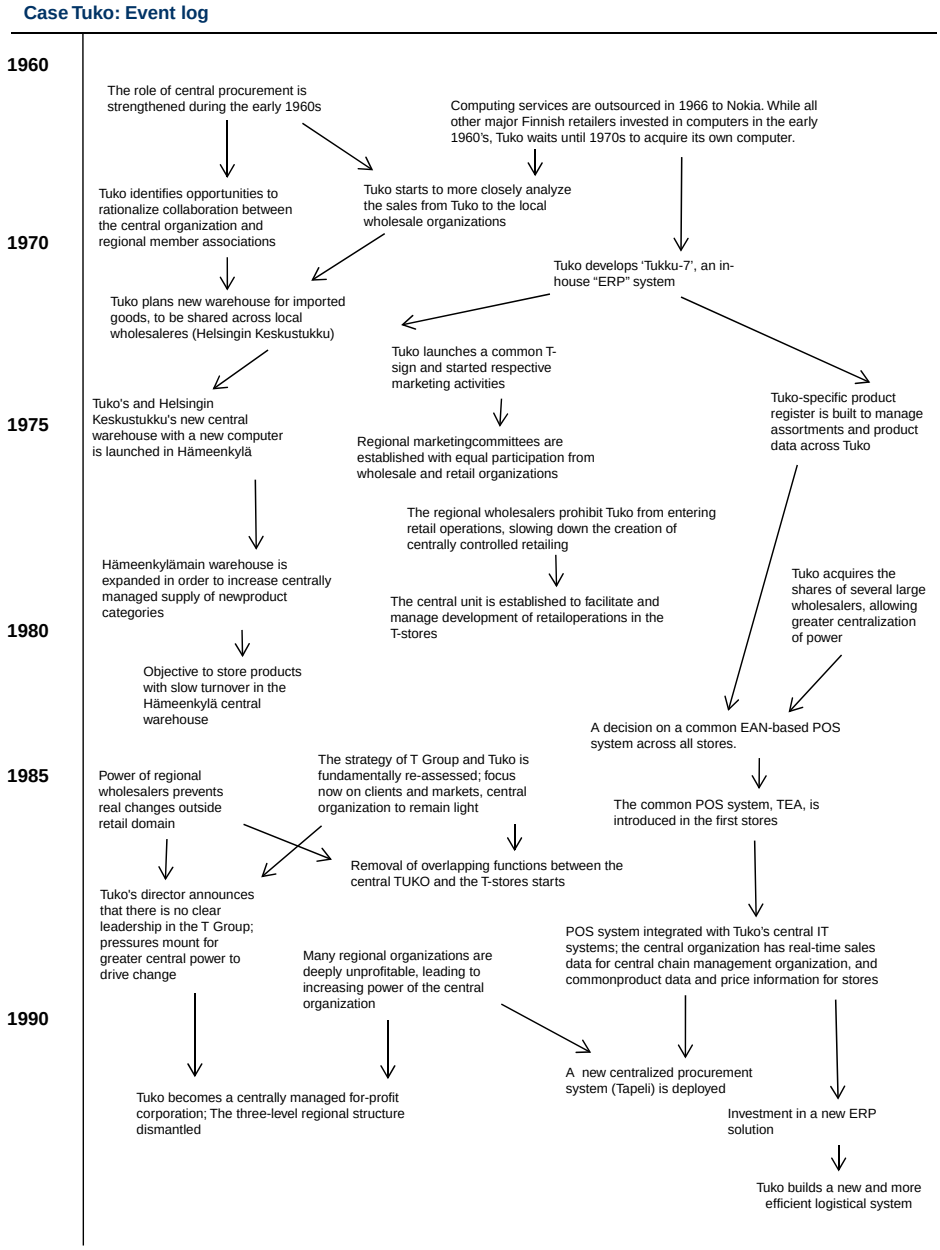
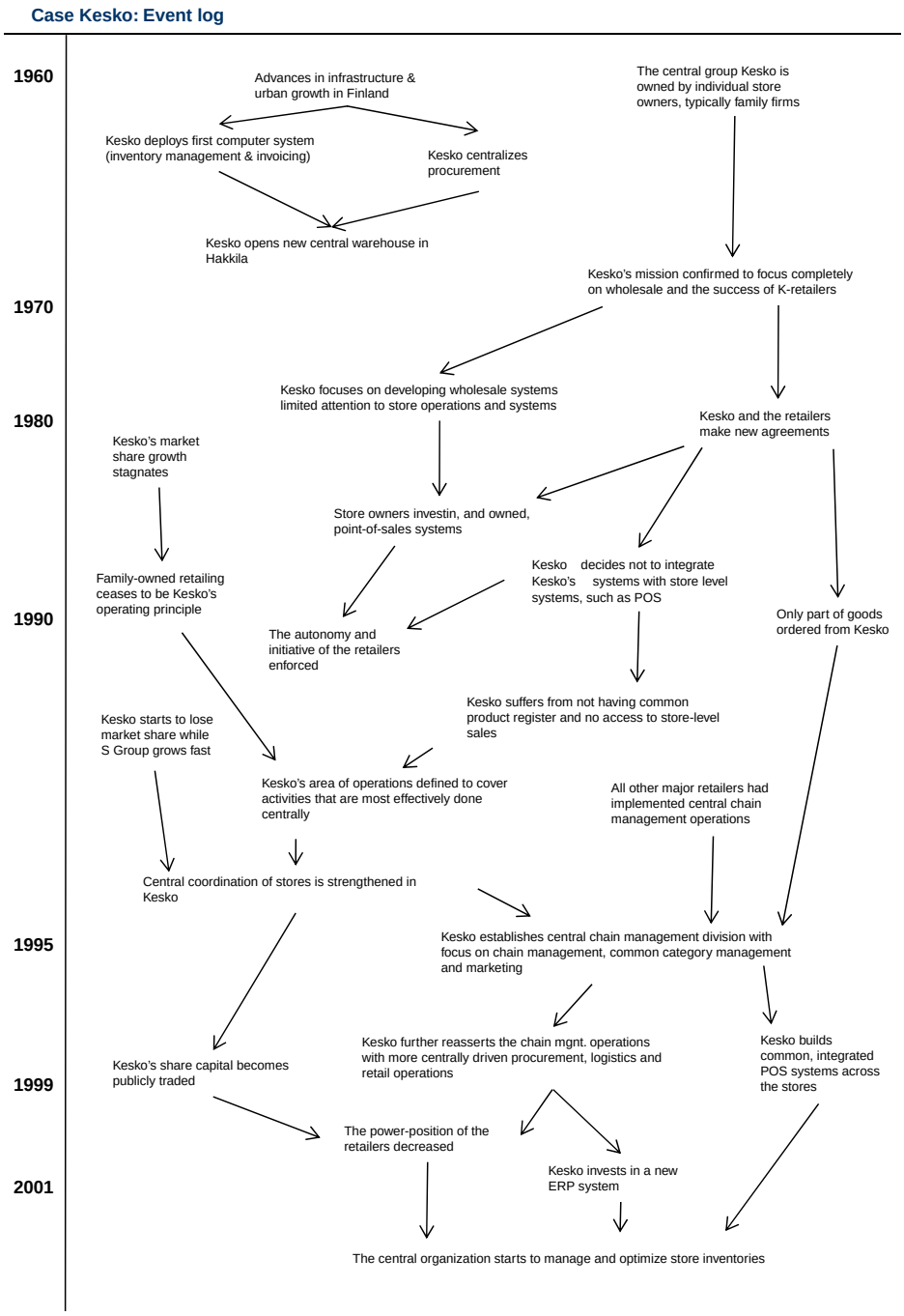
Appendix A: ETHNO Analysis of the Event Log in OTK



Appendix B: ETHNO Analysis of the Event Log in the S Group



Appendix C: ETHNO Analysis of the Event Log in TUKO



Appendix D: ETHNO Analysis of the Event Log in Kesko