INTERRELATED PATH DEPENDENCE OF TECHNOLOGICAL SYSTEMS AND ORGANIZATIONAL POWER RELATIONS

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ABSTRACT

In this article we examine the path dependence of intra-organizational power relations and their interdependency with technological path dependence. We first synthesize existing literature to demonstrate the interrelated path dependence of both technological systems and organizational power relations. We then present a longitudinal study of four retail organizations, describing how and why power relations influenced the timing of changes in IT systems, and how these changes reconfigured the power relations across various parties. Although the different sources of power clearly influenced IT investments, we also found that in the long run IT systems converged in all of the organizations due to broader institutional forces.

Keywords: path dependence; organizational power; information technology; retail industry; computers, historical analysis

INTRODUCTION

Typical studies of path dependence examine how differences across organizations can persist over time through endogenous process dynamics and increasing returns (for reviews, see Page, 2006; Puffert, 2002). For example, political theorists have noted how initial differences in political authority persist over time as a result of initial conditions and increasingly inert web of social commitments (Pierson, 2000). Thus far, the path dependence in power relations, either within or across organizations, has been largely overlooked in the field of organization studies. Yet, political processes have important ramifications on the evolution of organizations (Garud & Rappa, 1994; North, 1990).

Power and politics are also likely to influence the evolution of firm-level technological capabilities. For example, organizational power structures are known to influence the development and use of information technology (IT) (Jasperson et al., 2002). Powerful organizational actors can use their influence in decision making to direct evolution of technology towards a direction that serves their interests. Given that technological investments, such as large-scale computer installations (Pettigrew, 1973), may threaten the status and positions of individuals and departments, inter-organizational power relations are likely to influence technological adaptation and non-adaptation.

In this study we address these two gaps in extant literature on path dependence within organizations. First, we examine the *path dependence of power relations* within organizations, attending to the organizational dynamics that reproduce and escalate the initial differences in power relations. Second, we investigate how these path dependent positions of power interrelate with *technological path dependence*.

To study these potentially complex social dynamics, we adopt a longitudinal comparative research design. To enable comparative analysis, we investigate organizations that radically differed in their power structures and technological choices. Yet, to help draw inferences, we

looked for companies that were comparable in terms of their core activities and environment. We chose to study four organizations in Finnish retail sector. The research setting is a fruitful platform to study organizational path dependence and its consequences as the four organizations (1) represented the entire population of Finnish retail distribution and (2) each organization had a distinct governance structure.

Our findings suggest that power structures strongly co-evolve with technological systems – in our case, the IT systems of retailers. In the four case organizations we examined, the distribution of power gradually converged. However, the pace of changes was path dependent, relating to the pre-existing power of central organization accentuated by a small number of critical junctures (Mahoney, 2000). Largely, decisions to implement technological changes (and to postpone them) helped reproduce and reinforce the existing relationships, although eventually in all organizations technological changes increased the power of centralized headquarters.. The four retailers undertook similar technological investments, but at very different points in time. While power has a significant influence on technological path dependence, we suggest that in the long-term external influences trump internal power struggles, leading to implementation of new IT systems. In effect, the political struggles have merely a provisional influence on the implementation of IT. The use of power, or the anticipation of potential power struggles, postpones the introduction of new technologies but does not completely prevent the investments. Instead, institutional pressures, the evolution of technology, and the alignment of interests lead organizations to eventually implement new IT innovations. Simultaneously, the original power relations may change.

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. Power relations and technological system represent two interrelated elements within organizational structure, whereas path dependence refers to the process dynamics that guide changes in them. In the following, we provide a review and definitional discussion regarding the framework. 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.

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Insert Figure 1 about here

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Path dependence

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 20th century as a result of first-comer disadvantage. The early adaptation of machinery and other technological systems made it extremely difficult if not impossible to radically alter the stage of efficiency thus leading to faster development in the countries (e.g. Germany) that had the opportunity to bypass the earlier and relatively inefficient technologies. This bifacial nature of technological choices has largely remained in the focus of evolutionary research in organization theory. On the one hand, the adaptation and continuous use of a system generates capabilities (Kenney & von Burg, 1999; Teece, Pisano, & Shuen, 1997) and routines (Nelson & Winter, 1982) which incrementally improve the use

of the specific system. On the other hand, the large investments in the system make it increasingly difficult to conduct radical changes leading to relative inefficiency and decline (see e.g. Tripsas & Gavetti, 2000). Thus, technological choices are both subjects to rational choices and political processes (North, 1990; Pettigrew, 1973) on their relative costliness and effect on organizational evolution. This may be seen as the fundamental dilemma in the scientific discussion regarding path dependence.

Often, path dependence is simply meant to describe a situation in which an organization's previous investments and its repertoire of routines (its "history") constrain its future behavior (Teece et al., 1997). Following the classic work of David (1986), Puffert (2002) defined path dependence as the dependence of outcomes on the path of previous outcomes, rather than simply on current conditions. Thus, it is seen that choices made on the basis of transitory conditions persist long after those conditions change (Puffert, 2002). The existing literature in the context of evolutionary economics and economic history (Arthur, 1989; David, 1986; Nelson et al., 1982; Puffert, 2002) has found four types of conditions that give rise to path dependence: sunk costs, technical interrelatedness, increasing returns and dynamic increasing returns to adoption. First, path dependence may be based on the invested capital on equipment (cf. Hannan & Freeman, 1984). Second, technical interrelatedness means that a technological design builds up a hierarchical system in which some fundamental parts determine the pay-off matrix for any future technological choices (e.g. Murmann & Frenken, 2006). Third, increasing returns mean that organizations can benefit from maintaining the level and quality of their activities. Finally, the dynamic increasing returns to adoption (Arthur, 1989) means that small (random) events, even historical accidents, lead to early fluctuations in the importance of competing procedures and techniques.

The above characterization of path dependence has received critique from multiple directions (for a review, see Page, 2006). The most obvious criticism regards the question of

change. Namely, it is not realistic to assume that technological (or social) systems either change or do not change at all (e.g. Augier & Teece, 2006; Winter, 2006). This argument is especially persuasive when the idea of path dependence is imported to explain other than technological choices. For example, some political scientists have argued that it is not realistic to assume that institutional settings would be path dependent. Rather, laws and norms have the tendency to be in constant flux carrying certain amount of continuity yet being a subject to change and changing interpretations (Peters, Pierre, & King, 2005). Also, the discussion on QWERTY, VHS and other classic examples of assumed path dependence shows that it is extremely difficult if not impossible to find persuasive and history-independent examples of inferior technological choices (Page, 2006).

Referring to these criticisms, organization theorists and political scientists (Mahoney, 2000; Page, 2006; Pierson, 2000) have argued that more interesting and productive than to speculate about the existence of path dependence is to assume that many processes are dependent on their initial conditions and event sequences and thus to some (not specified) extent path dependent. Therefore, the attention should be on identifying sources and decision making processes that cause path dependence. One of the first studies that noted the importance of decision making parameters in path dependence was Liebowitz and Margolis (1990) article on the limitations of Paul David's theorization.

Liebowitz and Margolis built their argument on the notion that the David / Arthur type of path dependence approach lacks empirical evidence. Liebowitz and Margolis, for example, demonstrate that the argued inferiority of the QWERTY –keyboard does not receive any support from systematic historical research. The important conceptual advance of Liebowitz and Margolis is the notion that path dependence can be conceptualized to mean three different kinds of processes. The first-degree path dependence simply means that things are locked-in as a function of history. For example, a firm continues to use certain technology because the

sunk-costs to that technology prevent any short-time changes and because capabilities to utilize that technology have grown over time (Heffernan, 2003). According to Liebowitz and Margolis (1990), first-degree path dependence carries no implication that the dependence on initial conditions results in any inefficiency. Second-degree path dependence refers to a situation in which a technology can be seen inferior after the decision is made. Second degree path dependence then occurs when actions are only ex-ante efficient. However, the information is imperfect at the time of action as the actors do not know outcomes of their decision. Typically, actors' foresight is limited leading to decisions that are revealed to be inefficient. Finally, third-degree path dependence means that the technology is known to be inferior already before the decision. Accordingly, the three levels of path dependence can be conceptualized in terms of two dimensions; knowledge of alternative technologies and the inferiority of the choices.

The above characterization of different forms of path dependence demonstrates that to understand path dependence we need more information on how and why organizations make decisions. Already, some studies in the context of path dependence have attempted to acquire a more sophisticated view to decision-making beyond a rational choice perspective. Reviews of decision-making literature (Eisenhardt & Zbaracki, 1992; Langley, Mintzberg, Pitcher, Posada, & SaintMacary, 1995) show that organizational decision-making is characterized (1) by bounded rationality, (2) tendency to find problems for solution (i.e. the garbage can or anarchistic model of decision-making), and (3) the political nature of decision-making situations. To some extent, the existing management literature has linked these issues to path dependent processes. For example, Polaroid's top management failed to recognize a need to change the company's strategic focus mainly due a cognitive narrowness and misinterpretation of pay-offs resulting from focus on digital imaging (Tripsas et al., 2000). Kaplan et al. (2003) similarly demonstrate that a firm's responses to technological

discontinuities derived from the top management's cognitions. Lamberg and Tikkanen (2006), in their study of Finnish retail sector propose that managerial cognition affects strategic decisions and is modified by organizational structure, ideology and past investments on technology and capabilities. Despite these more micro-level approaches the existing literature on path dependence still ignores the notion of organizational power. Our argument, thus, is that to a large extent the different kinds of path dependence processes can be made more understandable by focusing on the power relations in an organization.

Power Relationships and Path Dependence

In organization studies, scholars have approached power from a number of different perspectives ranging from resource dependence to critical discursive formulations (Hardy & Clegg, 1996; Hardy & Phillips, 2002; Pfeffer & Salancik, 1978). Within this study, we will focus on zero-sum power relations across different organizational parties that influence organizational decision making, commonly known as 'domination' within sociological literature (Giddens, 1984; Lukes, 1974). Our strategy for theorizing the path dependence of power relations consists of first explicating the primary forms and sources of power and then tracking how power relations influence these sources either through positive or negative feedback loops (cf. Pierson, 2000).

While rational choice approaches to power have been prevalent in organization studies (Pfeffer et al., 1978), scholars have called for more encompassing appreciation of alternative forms of power (Hardy et al., 1996). Lukes (1974) suggests three forms of power in relationships across two parties: (1) direct power, the ability of one group to make decisions against the will of the other group, (2) conflict avoidance, the ability to influence decision making agenda and thereby prevent certain decisions, and (3) ideology, the influence on other party's perceptions of the world that facilitates beneficial decisions.

The sources of the first two forms of power are relatively similar and broadly covered by extant organizational literature, including for example: resource dependence (or the control of key resources), formal hierarchy, charisma, expertise, and persuasion. Instead, the third form of power originates from widely held norms and beliefs commonly conveyed through public discourse and originating beyond organizational boundaries (e.g. Hardy et al., 2002). Thus, we focus here on the two first forms that are more saliently influenced by intra-organizational factors.

While path dependence of power relationships has received very little attention, Pierson (2000) suggests that positions of political authority stemming from formal institutions can exhibit path dependent increasing returns. Once a party obtains a privileged position in decision making, it can force decisions that further reproduce its position in power. More specifically, we suggest that such increasing returns are the most likely to result from formally defined position in an organization, control of key resources, or structures influencing the distribution of information and knowledge.

To conclude, organizational power relations can take many forms and originate from many different sources. Power relations exhibit path dependence to the extent that parties can use the available sources of power to accumulate or increase their power over another party. We suggest that the path dependence of power relations can stem from the control of central resources, formal position in organizational hierarchy, and the distribution of information within the organization.

Interdependent Evolution of Technology and Power

In addition to increasing returns and history-driven evolutionary paths within organizational power relations and technological systems, these two are likely to interact. Extant research has documented how technological systems can provide certain actors with power over others (Barley, 1986). In reverse, actors with power can influence technology-related decision

making to their advantage. Such bidirectional relationship between technology and power has been most widely examined in IT-related literature (Jasperson et al., 2002).

In the IT domain the use of power, and even the concerns of potential alterations in power positions, have been said to impact the entire IT lifecycle including IT-related decision making, design of IT, implementation of IT, and utilization of IT in organizations (Robey, 1997; Weill & Olson, 1989; Zuboff, 1988). The empirical studies demonstrate how individuals and groups are sensitive to the power-related outcomes of IT initiatives and how this is manifested in resistance to and promotion of IT-related changes.

As a recurring theme, IT literature has identified the information-based sources of power as a central consequence of IT system implementations (Lee, 1991). The decisions to implement IT systems influence collection and distribution of information across different parties, thereby empowering parties who previously lacked access to information and facilitating hierarchical control (Jasperson et al., 2002). In addition, technology implementation is often accompanied with changes in organizational routines and resource flows (Barley, 1986). Such changes have potential implications for resource dependencies across various parties, as well as the expertise required from different actors. Thus, IT implementation, when accompanied by wider changes in organizational practices, can exhibit a broad range of implications for the relative power positions.

Extant research suggests that organizational parties are commonly aware of the changes IT systems may impose on organizational routines, information distribution, and resource dependencies. Thus, various parties are likely to leverage their power relationships to influence or resist IT-related decisions (Franz & Robey, 1984). It seems likely that, over time, all organizational parties become increasingly aware of power implications of IT systems, and that major technological changes are also political processes within organizations.

To summarize, changes in IT systems are likely to influence power relationships either by providing new information to certain parties, or by shaping the organizational routines and tasks so that there are changes in resource dependencies or required expertise. On the other hand, power relations are likely to influence already the decision-making on new IT investments as organizational actors anticipate that IT implementation will shape the power relations within the organization.

METHOD AND DATA

The study focuses on the four dominant retail organizations in Finland from day computers were first introduced in the retail industry, that is in November 1959, to the present time, 2005. For the entire period, the four retailers, Kesko, OTK/EKA, S Group, and Tuko, had a combined market share of over 90 % of the Finnish grocery business. Studying the four retail organizations enabled us thus to cover the co-evolution of IT and power relations in one specific industry during the entire lifetime of digital computing. As we analyzed the IT and organizational development in four retailers, we were also able to comparative analysis on the similarities and discrepancies in the evolutionary paths of IT and power in the organizations.

Data collection

We started our research by collecting historic studies on information technology in the Finnish retail sector (Manninen, 2003; Tienari, 1993). We continued by gathering company histories (Herranen, 2004; Hoffman, 1983, 1990; Kallenautio, 1992), published studies (Lamberg et al., 2006; Lehti, 1990; Mitronen, 2001; Skurnik, 2002), annual reports, newspaper articles, industry studies, and press releases. To further complete our data and to obtain insights from practitioners inside the organizations, we interviewed seven long time IT professionals in the four retailers. The interviewees had each had long careers in the IT departments of one or more of the case organizations. They had held different kind of

positions in the IT departments, many had started as programmers in the 1960's and now held positions as IT managers and CIO's, some already retired. The interviews were semi-structured and lasted 1,5 - 2,5 hours. The interviews were taped and transcribed. We also had several follow up discussion and e-mail correspondence to complete and verify our data. In addition to the interviews, we talked to retail industry experts (e.g. to a IBM account director for the retail industry in Finland in the 1960's and 1970's) and to other people from the case organizations.

The history of power relations and organizational change of the Finnish retail companies is well documented in academic studies (Lamberg et al., 2006; Lehti, 1990; Mitronen, 2001; Skurnik, 2002). Luckily, we were able to use this knowledge in the acquisition of data. Specifically for this study, we collected 2206 decision and strategy statements from the Annual reports and studied the archives of two companies providing access to their material. The archival material was especially useful in the triangulation of the knowledge gathered from other sources.

Analysis

Since we did not find extensive and reliable accounts of the evolution of IT in the Finnish retail business, we started our data analysis by writing historical accounts for all four case organizations. These "IT histories" focused on the use of IT in the organizations, meaning that we were mostly interested in how the retailers applied information systems in their business, not so much about the nature and properties of the underlying technologies. Our perspective on the evolution of IT and organizations was thus fairly similar to other recent studies on the influence of IT on industries and organizations (Cortada, 2004; Yates, 2005). The histories cover the entire computer-era in all four organizations, starting from the introduction of first computers in the late 1950s and continuing to the deployment of automatic replenishment applications and voice-directed warehouse systems in the mid 2000's. The histories are about

10-15 single-spaced pages long documents for each organization providing detailed descriptions about the characteristics of the IT evolution in Kesko, OTK, S Group, and Tuko. The historical accounts were reviewed and corrected after consulting the same people we had interviewed.

In addition to the historical accounts, we quantified the use of IT in the organizations during the researched period. We identified all the major steps in the evolution of the IT applications in the case organizations during the five decades. We also listed the main advancements concerning the development of the IT infrastructure, such as the introduction of the first computers in the organizations. We were able to identify more than 40 distinctive steps in the use of IT in the organizations. We were fully aware that, in addition to launching new applications and technologies, the development of information systems in the organizations had been characterized by continuous and progressive IT development, which meant that a lot of the incremental IT work in the organizations was excluded in our quantitative analysis. However, as our approach to data analysis was to ground our findings on the qualitative data and then to compare our analysis on the qualitative results, the quantification of the use of IT in the case organizations was found to serve well our aims.

As we were interested in the relationship between power and IT evolution in the organizations, we analyzed the identified steps in the use of IT according to their potential implications on the power relations between the headquarters, i.e. the central organization, and local organizations, i.e. the regional and store level operations. Specifically, we sought to understand how the managers in the independent regional offices and stores, including potential storekeepers, would conceive the IT investments and their potential consequences on the existing power structures and their autonomy. To quantify this, we estimated the potential conflict of interests the new IT application would cause between the central and local organizations. The scale for the possibility for conflicting interests ranged from very low (1)

to very high (5). For example, introduction of an accounting system in the head office was evaluated to receive little attention from the regional and store level managers, whereas the deployment of point-of-sales (POS) systems was assessed to be a very delicate and conflicting decision since it implied new information flows to the headquarters.

Similarly, we coded and plotted all statements from the Annual reports by giving a value -5 to statements that manifested core (i.e. central organization) domination and 5 to statements that manifested periphery (i.e. stores and local sub-units) domination. In the coding, we an interpretative approach in which the use of words and contextualized meaning of the statements was used as a decision criteria for coding. The analyzed data was the used in a comparative illustration of the different development paths of the organizations vis-à-vis power relations.

Once we had completed our evaluation of the potential delay and resistance regarding each IT application, we went through the IT histories once again to find out when the different organizations had introduced the applications and technologies for the first time. In some cases, we lacked data from two or more organizations so that we could not specify when the application had been introduced in these organizations. We dropped these IT applications from our analysis. We ended up with a set of 34 retail applications and technologies where we had a data about the time of introduction from at least three organizations out of four. By comparing the dates, we ranked the organizations in the order they had introduced each application. We gave 4 points to the organization if it had been the first to introduce the new technology and 1 if it had been the last one. If two, or more, organization had introduced an application during the same year, we shared the points (e.g. 3,5 and 3,5). The IT applications and technologies and their potential impact on power structures between central firm and regions/stores are presented in the Table 1.

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Insert Table 1 about here

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EVOLUTION OF POWER RELATIONS IN THE FINNISH RETAIL INDUSTRY

The Finnish retail industry in the 20th century is a development story of four organizations (Kesko, TUKO, S Group and OTK) which emerged in a rural semi-monetary society in the beginning of the last century and ended in the IT –driven business environment of the 21st century (Hjerppe, 1989; Skurnik, 2002). What make the story interesting are the initial differences in the ideology and power structure which then persisted until the 1980s and 1990s.

Originally, S Group and OTK belonged in one association of local cooperatives. In 1917 this cooperative association was divided in two separate organizations of which OTK followed a socialist ideology and S Group a peasant or agrarian principles. Despite the divide, the later development of these two associations followed very similar paths. First, until the 1980s both organizations served the interests of a large number of local cooperatives. The fragmentation meant that the central organizations had much power in upstream and service operations (logistics; accounting systems; education; manufacturing; marketing) whereas the local cooperatives controlled the downstream activities in retailing. In OTK the organization of retail activities was especially complex as an ideological non-profit association (KK) was responsible for planning of retail activities (e.g. store concepts), local cooperatives owned the outlets and warehouses yet OTK controlled manufacturing, logistics, assortment policy and other elements necessary for the other parts of the organization. Although the planning function was transferred to OTK in 1970 the organization remained relatively complex. SOK was probably more effectively organized but obtained similar problems in strategic retail operations such as the founding of new store concepts.

Second, both OTK and S Group had to deal with the large number of cooperatives. This meant that the largest cooperatives were able to dominate decision making and, for example, prevent large-scale organizational and strategic changes in retailing. To some extent the central organizations used this situation in expanding manufacturing operations which were a subject of less controversy. At the same time, however, smaller cooperatives faced increasing economic problems as the retailing business became more capital intensive and competition more fierce. These economic problems caused a wave of mergers between local cooperatives. However, only the threat of bankruptcy in both S Group and OTK allowed more radical structural changes. In 1983 39 local cooperatives merged with OTK to form one national cooperative, EKA. Only the large Helsinki based Elanto refused to join the new organization. A year later, over 180 S Group cooperatives merged to 39 larger units which then allowed S Group to start a series of rationalization and renewal processes. The convergence in organizational structure also meant transfer of power from the local level to the headquarters. This tendency became even stronger during the 1980s and 1990s when both cooperatives adopted centralized chain management logic resulting in almost total dominance in resource allocation and information flows. Characteristically, S Group abandoned its status as an ideological cooperative in the early 1990s. OTK/EKA was first descended in the control of its debtors in 1992 and was later acquired by an international investor group in the early 2000.

TUKO and Kesko were founded during Finland's wars with Soviet Union (1939-1944) to represent independent wholesalers and retailers in the wartime rationing system. The initial difference in the ownership structure of these two companies was that Kesko was owned by individual retailers and their representative association whereas TUKO by local wholesale companies. For TUKO this meant constant struggle between the divergent interests of the wholesalers on the one hand and on the other, between the wholesalers and TUKO. The wholesalers, for example, prevented the building of hypermarket size outlets by (1) refusing

or not being able to invest their own resources on these very costly projects and (2) not letting TUKO to have its own retailing activities. Quite similarly to what happened in the cooperatives S Group and OTK, TUKO's local owners also incrementally drifted in economic difficulties and were acquired by TUKO. However, the re-structuration did not save Tuko and in the early 1990s the entire group became a victim of aggressive financial speculations simultaneously with nation-wide economic downturn. In 1996, TUKO was sold to Kesko and then parceled in several smaller companies when the EU's competition authorities refused to accept the pact.

In the 1940s, Kesko was the smallest of the four retail organizations. However, in two decades Kesko took the leading position especially in grocery sector as a result of very aggressive competitive moves in store founding and development of new business concepts. Clearly, Kesko was a success story benefiting from its proactive retailer-owners and focused central organizations. For the later development, however, Kesko's rapid expansion meant unexpected stickiness in power relations. Namely, to achieve growth in the retail market Kesko faced constant need for capital. In the 1960s and 1970s, Kesko engaged in a series of currency operations but more importantly, it organized stock offerings directed to its retailers. As a consequence, the power of the retailers increased along the decades. This development was accentuated by an strengthening ideology of private entrepreneurship as the core element of Kesko's culture and business model. The rise of retailers' power culminated in the 1980s when Kesko dramatically decentralized advertising, inventory management, assortment planning and other vital strategic operations. Although the competitive success of especially S Group soon demonstrated the strength of a centralized retail organization Kesko continued to struggle between the interests of the retailers and the very obvious demands of the market environment. Only in the late 1990s the two separate stock series were integrated and finally

the retailers accepted the need to centrally organize some of the most obvious operations such as buying and inventory management.

Figure 2 illustrates the relative changes in the locus of attention. The illustrated development summarizes the above historical account: all four organizations incrementally converged towards a highly centralized and focused activity mode. In the beginning Kesko and S Group were clearly more dominated by local interests (i.e. retailers and local cooperatives) whereas TUKO and OTK were active in manufacturing. In the latter cases, this meant also avoidance of conflict with local interests. Also, Kesko's decentralization in the 1980s forms 'a peak in the curve' emphasizing idiographic development path of the company.

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Insert Figure 2 about here

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EVOLUTION OF IT IN THE FINNISH RETAIL INDUSTRY

Since the co-operative retailer Elanto received its first computer in November 1959 (Manninen, 2003), Finnish retailers have been making significant investments to IT in order to conduct their business processes more efficiently and effectively. Finnish retailers have used IT in all parts of the retail value chain, from procurement to logistics operations to post-sale customer service. IT has enabled the retailers to obtain vast amounts of more detailed and current information about the trade, such as product level sales and turnover rate of the assortments, and has eventually led to dramatic changes in the strategic direction of the firms (Lamberg et al., 2006).

The first computers were mainly utilized for two different purposes, for warehouse operations, such as inventory management and order picking, and for administrative processes, such as payroll calculation and book keeping. In the 1960's computers were also used to manage product data, pricing, and invoicing. One of the leading retailers, Kesko, was

also pioneering data communications in Finland when it implemented an electronic data interchange between its head office and Joensuu regional office in March 1964 (Kimmo, 1993; Manninen, 2003).

In the 1970's the use of IT grew exponentially in the Finnish retailers. Computers were applied to facilitate supply management, demand planning, order entry, transport planning, and different kind of analysis on performance. In the mid 1970's the store personnel also had their first encounters with information technology as Kesko's stores introduced portable ordering devices for sending replenishment orders electronically to the warehouse. Applications of IT continued to increase significantly in the 1980's in areas such as supply chain management, assortment and product data management, and administration. However, the most disruptive technologies for the retail industry were the bar codes and the POS terminals that were already launched in the late 1970's and become more common in the late 1980's. POS systems enabled the integration store level sales to central logistics and warehousing and eventually led to fundamental changes in supply chain management, inventory management, assortment planning and in the overall chain concepts of the retailers.

In the 1990's and in early 2000's, many of the existing applications were replaced by off the shelf software, such as commercial enterprise resource planning (ERP) systems. New application areas included management of chain operations, vendor-managed inventory (VMI), terminal management, and the management of customer data and loyalty programs. The growth of commercial software, including ERP's continued in the 2000's. The retailers optimized their automatic replenishment systems, built more sophisticated data mining and analysis applications, renewed their financial systems, and carried on the work to improve the consistency and quality of the product, suppliers, and customer data in the information systems.

The evolution of IT in the four Finnish retailers has been similar in the sense that most firms have implemented identical applications and many times even the same technologies and commercial products to support their organizational processes. As an example, all four retailers acquired hand held terminals from a Swedish vendor Micronic to enable store personnel to enter replenishment orders directly as they inspected shelf inventory. However, the same applications and technologies were implemented at a very different points in time in the organizations. Kesko introduced the Micronic terminals about five years before OTK but implemented common POS systems in the stores almost 10 years after OTK. Likewise, Tuko started to apply computers to optimize replenishment orders in the early 1980's whereas S Group deployed similar applications in the beginning of the 1990's. This paper argues that the existing power structures and relationships impacted the evolution of the IT in Kesko, OTK, S Group, and Tuko, so that the organizations with more central allocation of decision rights were able to adopt and deploy the new innovations faster than the other organizations.

The years when the organizations introduced the new IT applications are given in the Table 2. We will now shortly review the evolution of IT in the organizations and highlight how the organizational power relations have impacted the IT development in the retailers.

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Kesko

Kesko deployed their first computer, ICT 1500, in 1964 (Kimmo, 1993) which was few years later than biggest rivals OTK and S Group. However, Kesko soon took the leading position in the use of IT in retailing. Whereas OTK used the first computers for administrative tasks, Kesko applied the computers immediately for operational purposes. Computerization at Kesko coincided with the construction of a new central warehouse in Vantaa, enabling Kesko

to automate many warehouse processes, such as inventory management. Kesko started to transmit order data from the regions to the central warehouse from early on, initially using Addo-X punch tape transmitters. In the late 60's, Kesko redesigned its material management systems and built new online systems where incoming orders were compared to real time inventory data so that the system could check whether the goods were available or not. Kesko continued to develop their warehouse and supply chain systems actively in the 1970's. In 1976, Kesko was the first retailer to introduce hand held order entry terminals in stores.

In the 1980's, Kesko continued to invest heavily in supply chain management systems. One major milestone was the construction of a new integrated and enterprise wide resource management system, YJ83, that was launched in 1983. This system covered demand management, supply management, warehouse operations and procurement and remained in production use almost 20 years until the 2000's. In 1986, Kesko built a standard electronic data interchange (EDI) connection with a dairy vendor Valio, again first in Finland.

Point-of-sales systems were introduced in the Finnish retail stores in the late 1970's but did not become common until the end of the 1980's when EAN codes and bar codes were attached to products. In the 1980's Kesko gave recommendations on potential POS vendors to the independent storekeepers but Kesko itself did not participate in the implementation of the systems in the stores. Deployment of POS systems was left to storekeepers and their POS vendors. In 1988 Kesko's CEO even decided that, because of the independence of the storekeepers, Kesko will not integrate the store level POS systems to Kesko's own information systems. While many stores in the Kesko group, especially the larger ones, acquired POS systems by themselves, it was not until 1995 that Kesko created a new company, K-Linkki, to support the development and deployment of common POS systems in stores. Eventually, in 1995, Kesko was forced to purchase the existing POS systems from the storekeepers after which it took them three years to deploy the new POS systems in all 800

retail outlets. In the end, the IT pioneer of the Finnish retail was more than 10 years behind in taking the full advantage of the technology that was, in addition to logistics and supply chain management systems, perhaps the most business critical application in the retail industry.

OTK

When the cooperative Elanto, that belonged to the OTK group, got their first computer in 1959, there were only two computers in commercial use in Finland, one at the government owned bank, Postipankki, and the other at the Social Insurance Institution of Finland (Runko, 1993). OTK received their first computer, a Ramac 305, a year later, in 1960. First computers were used for payroll calculation and book keeping, in other words to automate administrative routines. It was not until the 1970's that OTK started to apply computers to support the warehouse operations. In the early 1970's OTK used IBM S/360 mainframe computers to manage inventories in the warehouse, analyze store-level sales, handle invoicing and to conduct financial accounting processes. In the late 1970's OTK started to implement a new enterprise system. In 1977 OTK deployed a new material management system and a year later a new warehouse system. In 1978 OTK decided also to implement a distributed computing environment where regional distribution centers were assigned with computers. The regional computers were in the beginning stand alone systems with no communications with each other or with the central computer. Connections between the regional and central computers were established later in 1982-1983.

In the late 1970's some of the regional co-operatives in the OTK group purchased POS systems but at the time the they were installed only in the largest stores. With the merger of 39 independent regional co-operatives to a national E-co-operative in 1983, OTK, that was re-named Eka, became the first centrally managed major retail organization in Finland. The central management of the perishables business of the Eka group resulted in an immediate deployment of POS systems in its retail chains. During 1984-1986 Eka deployed POS systems

in the Siwa-store and during the in the next few years in Eka-hypermarkets and in the Valintatalo-stores that had been acquired in 1986. All in all, POS systems were deployed in 800-900 retail units. OTK was years ahead from other Finnish retailers in the introduction of common POS systems in the stores. About ten years later, in 1996-1997, OTK which at the time was called Tradeka, implemented a new generation of POS systems in the stores about the same time when Kesko was introducing their own common POS systems for the first time.

In 1991 OTK, at the time EKA, and S Group founded a joint venture Inex Partners, that became the joint procurement and logistics company for both OTK and S Group. Concerning the IT systems of the new company, OTK's existing logistics and warehouse systems were transferred to Inex Partners as OTK's systems were assessed to be more cost efficient and flexible than S Group's. In 1993, OTK launched their customer loyalty program being the first retailer in Finland to do so. In 1996, OTK, at the time called Tradeka, implemented a commercial ERP system again years ahead from Kesko, S Group and Tuko.

S Group

S Group ordered their first computer in 1960 or in 1961. The first computers were used for invoicing and compiling statistics about the deliveries from the warehouse. Until 1967 most of the IT applications utilized bunch cards as data collection and entry tools, which meant that the inventory data was not updated real time but the deliveries were recorded to the systems only after the transactions had taken place. In 1967 S Group acquired an IBM S/360 mainframe and built an updated version of the warehouse system that was able to process real time data on inventory, a system similar to what Kesko had implemented already in 1964. However, whereas in the late 1960's Kesko had already implemented electronic data transfer from the regional offices, in S Group the orders from the regional warehouses were phoned to the central warehouse. So, while S Group received their computer few years earlier than

Kesko, in the 1960's S Group's systems were lacking many features that Kesko had already built.

S Group was developing new IT applications very actively during the 1970's. New systems were built for logistics, procurement, sales analysis, book keeping, accounts payable and receivable, and invoicing. In addition, a new warehouse system was built in the late 1970's. With the new warehouse system S Group implemented a product database for all goods that were delivered from the central warehouse. (The regional co-operatives could also order goods directly from suppliers if they chose to do so.) In the early 1970's the regional co-operatives got their first computers that were at first used for administrative tasks. In the late 1970's hand held order entry terminal were introduced in the stores. Some regional co-operatives also started to implement POS systems but it took still about ten years for the POS systems to become widely diffused in S Group's stores.

In the early 1980's S Group built systems for office automation and successfully implemented the systems in the central organization as well as in the regions. In 1983, S Group was restructured to consist of the central organization, SOK, and the number of regional co-operatives was reduced from about 200 to 35. Developments in the IT domain during the restructuring included a new online order entry system for the stores, purchasing system, clearing and forwarding, and invoicing. However, many of these systems were targeted to managing the internal sales and invoicing within the S Group, i.e. between the regional co-operatives and the central SOK organizations. It was not until the late 1980's when S Group created a new strategy where it set the guidelines for the future retail chains that S Group started to systematically renew its IT systems to better meet the demands of the chains and store level operations. The new 1988 IT strategy also comprised plans to develop a customer-owner data management system.

The first outcome of the new IT strategy set in the late 1980's was a common POS system that was introduced in most of the stores during 1991-1993. However, some regional co-operatives decided not to invest in new POS systems which meant S Group had to create interfaces to integrate several different POS systems to their central material management systems. In the early 2000's some regional co-operatives had still not implemented the standard POS systems in all their stores. After the POS deployment, the IT development resources were targeted to building a new order management system, enterprise resource management system, several different administrative systems, and eventually the customer owner system that was deployed in the middle of the 1990's. S Group was in many ways leading the IT development in the Finnish retail industry in the 1990's and in the 2000's. One example of this was the sales-based ordering system that S Group built and deployed in the late 1990's years ahead from competitors.

Tuko

While some of the local wholesale firms, that jointly owned Tuko, may have acquired computes in the 1960's, Tuko was a late adopter of IT. Tuko received its first computer in the early 1970's and founded a computer department in 1973. Tuko started to design the first operative information system, "Tukku-7", in 1972. The system was used for managing warehouse book keeping, invoicing, customer statistics, purchase statistics, accounts payable and receivable, warehouse optimization and order processing. In 1974 Tuko created a common product data register that was aimed to provide all companies in the Tuko group, i.e. the central and the regional wholesale businesses, unified product data. By 1977 the database register was implemented in the central warehouse and in four regional wholesale firms. In 1975 Tuko, together with Helsingin Keskustukku, built a new central warehouse in Vantaa. A new information system was developed to support the warehouse operations such as receiving, picking and dispatching.

Around 1980 the first hand held order entry terminals were taken into use in Tuko stores, called T-stores. In 1981 Tuko implemented a real time material management system where the orders from the regional wholesale firms were transmitted by telecommunications to the central system that processed the data was automatically. While the wholesale operations, including the development of wholesale information systems, were independently managed by the regional wholesale firms, the store level operations were centrally developed by a "field unit" in the Tuko organization. This enabled Tuko to develop common ordering management and POS systems for the stores. The so called ETAM statistics helped the storekeepers to assess demand. The POS system, called TEA system, was introduced in the middle of 1980's which was relatively early in the Finnish retail sector. Also, with the new system Tuko was the first retailer in Finland to collect product-level data on sales. However, despite the early start, it took fairly long for all the T-stores to acquire the new TEA system. By 1987, TEA system was installed in 31 T-stores and the deployment proceeded slowly so that by the end of 1990 TEA system was in use in 170 T stores covering only 55 % of the total retail sales in the T stores. 1991 Tuko started to build a new version of the TEA system. All in all the system was very lasting and it remained in use up until 2006 when S Group acquired Tuko's retail operations.

Tuko was restructured in the early 1990's which meant that the regional wholesale firms were closed down. As a result of the restructuring, the number of different supply chain systems that had been developed in the different regions was also reduced and the remaining systems became centrally managed. In 1996 Kesko acquired Tuko, though it eventually got to keep only the department store Anttila, not the retail business. In 1997 Tuko implemented a new warehouse management system, called OpenWarehouse. Anticipating potential Y2k problems, the existing POS system, TEA, was upgraded in 1998-1999. Tuko implemented SAP Retail in 2001 in logistics and in finance. Other major IT implementations in the 2000's

included a vendor managed inventory systems, new warehouse management system, and a voice-directed picking system.

FINDINGS

Our analysis indicated the distinctive paths the different organizations took in their IT development. Despite its slightly lagged start, Kesko was clearly a frontrunner in the use of IT during the 1960's and 1970's. During this period, the systems had little impact on the relatively strong position of retail outlets, as computer systems were conceived to help the central organization provide "services" to retailers. Consequently, politics did not play a major role. However, as the computers entered the retail stores in the 1980's, Kesko was slow to react (see Figure 4). In particular, the retail owners resisted the implementation of IT systems that would have provided headquarters with detailed information of retail activities.

OTK was quick to adopt computers and information systems in all areas of the retail value chain. And since the 1983 merger of regional co-operatives and the foundation of a centrally governed E-co-operative, OTK was the only retail organization that was able to make centralized decisions about store-specific processes and operations which enabled OTK to adopt POS systems and other store level operations systems years ahead from competitors.

S Group was also actively developing IT systems to support its operational and administrative processes in the 1960's and 1970's. However, S Group slightly loosed the momentum in the 1980's concerning especially the store-level information systems. After the major restructuring in the 1984 and the new chain oriented business and IT strategies in the late 1980's, the IT development in S Group started to gain advance more rabidly and more consistently.

Tuko was initially a late adopter of IT, but was started to invest heavily on IT in the 1970's and to catch competitors in the utilization of IT. Tuko was also quick to start developing POS systems, in 1982, but because of the independence of the regional wholesale firms and the

stores, lack of centralized authority meant that the deployment of the POS system advanced slowly and gradually.

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Insert Figures 3 and 4 about here

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Our qualitative analysis is supported by a graphical analysis of the data, reported in Figure 3. The figure shows the relative ranking for Kesko, OTK, S Group and Tuko in the use of IT as a function of the potential conflict of interests associated with the IT. Accordingly, Kesko was the most innovative in the use of IT in centrally managed processes, such as logistics and warehouse operations, but as the possibility of conflicting interest increases, Kesko's relative position decreases. For all the other organizations, the potential conflict of interests slightly improves the relative ranking of the organization, largely due to the significant decrease in Kesko's ranking. In OTK, this can be attributed to the centralized decision-making on both logistics and store level operations. Tuko again had a dedicated "field unit" that was given the role to develop store level processes and information systems despite the decentralized decision making for logistics. For S Group the difference in the relative ranking is most narrow suggesting that while it had succeeded to implement new IT innovations in store at a faster pace than Kesko, its decision making processes for store level IT systems in the 1980's and 1990's was somewhat more complicated and ineffective than in OTK and Tuko.

While we found that the pacing of technology implementation was considerably slower in Kesko (and to some extent also in Tuko during 1980s) where central headquarters lacked clear authority over retailers, the technology and power structure eventually converged in all four organizations during the study period. Technological and political path dependence within organizations were trumped by larger societal forces – technological advances that

become vital for competitiveness, and the broader normative move towards centralized and hierarchical governance of the corporations

CONCLUSION

In this article we have examined the interrelated path dependence of technological systems and power relations. Based on our review of existing literature, we argued that the path dependence of power relations and technological systems is interrelated. Consequently, we analyzed the four Finnish retail organizations to investigate the evolution of power relations among organizational parties and their decisions to implement IT systems.

Our results corroborated our theoretical framework. Specifically, we found that the organizations where the central office was more powerful implemented earlier IT systems that reinforced the central command. In Kesko, where retail outlet owners were far more powerful than in other groups, information systems that enhanced the power of the central office were implemented significantly later. While our study suggests that power relations influence technological paths, our results also broadly suggested that external institutional pressures created eventual convergence in all four organizations we examined.

Although our results are related to IT systems in particular, we feel that the framework offered here provides more encompassing implications for other technological systems equally. Many production systems have implications to actors' positions of power. Organizational decisions to implement technological change are thus likely to at least partially stem from vested interests and historical path dependent power relationships. Moreover, while we examined intra-organizational power relationships, similar issues might be identifiable at industry level as well. For example, the evolution of mobile phone technology is likely to be at least partially influenced by the mutual power relations between handset manufacturers and telecom operators.

Our study is of course not without limitations. Since we only investigated one industry in one country, we are unable to provide statistically significant quantitative backing for our claims. However, we tried to attain a thorough understanding of the industry and specifically technology-related decision making in the four case organizations, giving us confidence in our interpretation of the reasons underlying the variance in the time of implementation. Nevertheless, many of modern corporations may be controlled by strict hierarchical command, which would preclude such resistance and politics we observed in Kesko. Thus, the applicability of our model seems bounded to those organizations where hierarchical power can be either explicitly or covertly contested.

Our research suggests an interesting direction for future studies within the interactions of path-dependent organizational sub-systems. Whereas we theorized and examined the interdependencies between technological structures and power structures, future research may look at other forms of path dependence, such as that existing in between alliance networks and technological systems, for example.

To conclude, we have here extended the organizational path dependence research to cover power relations. This is an area where path dependence and increasing returns cannot be measured in monetary value. Instead, the benefits are more particular and specific to the intra-organizational groups of actors. While such details of organizational dynamics are easily lost from economic macro-perspective, these dynamics have important ramifications for individual employees. To the extent political path dependency prevents the implementation of efficient technological solutions, they ought to also concern managers and owners of the corporations.

REFERENCES

Arthur, B. W. 1989. Competing technologies, increasing returns, and lock-in by historical events. ***Economic Journal***, 99: 116-132.

Augier, M., & Teece, D. J. 2006. Understanding complex organization: the role of know-how, internal structure, and human behavior in the evolution of capabilities. ***Industrial and Corporate Change***, 15: 395-416.

Barley, S. R. 1986. Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments. ***Administrative Science Quarterly***, 31(1): 78-108.

Cortada, J. W. 2004. ***The Digital Hand: How Computers Changed the Work of American Manufacturing, Transportation, and Retail Industries***. New York: Oxford University Press.

David, P. 1986. Understanding the economics of QWERTY: The necessity of history' In W. Parker (Ed.), ***Economic history and the modern economist***: 30-49. New York: Basil Blackwell.

Eisenhardt, K. M., & Zbaracki, M. J. 1992. Strategic decision making. ***Strategic Management Journal***, 17(1): 17-37.

Franz, C. R., & Robey, D. 1984. An Investigation of User-Led Systems Design: Rational and Political Perspectives. ***Communications of ACM***, 27(12): 1202-1209.

Garud, R., & Rappa, M. A. 1994. A Sociocognitive Model of Technology Evolution - the Case of Cochlear Implants. ***Organization Science***, 5(3): 344-362.

Giddens, A. 1984. ***The Constitution of Society***. Cambridge: Polity Press.

Hannan, M. T., & Freeman, J. 1984. Structural Inertia and Organizational Change. ***American Sociological Review***, 49(2): 149-164.

Hardy, C., & Clegg, S. 1996. Some Dare Call it Power. In S. Clegg, C. Hardy, & W. R. Nord (Eds.), ***Handbook of Organization Studies***. London: Sage Publications.

Hardy, C., & Phillips, N. 2002. Discourse and Power. In D. Grant, C. Hardy, C. Oswick, & L. Putnam (Eds.), ***The Sage Handbook of Organizational Discourse***. London: Sage Publications Ltd.

Heffernan, G. M. 2003. Path Dependence, Behavioral Rules, and the Role of Entrepreneurship in Economic Change: The Case of the Automobile Industry. ***Review of Austrian Economics***, 16: 45-62.

Herranen, T. 2004. ***The history of SOK (Yhdessä eteenpäin: SOK 100 vuotta: 1904-2004)***. Helsinki: Edita.

Hjerppe, R. 1989. ***The Finnish economy 1960-1985: growth and structural change***. Helsinki: Suomen Pankki.

Hoffman, K. 1983. ***History of K-group (K-Kaupan historia)***. Helsinki: Kauppiaiden Kustannus.

Hoffman, K. 1990. ***Kesko 1940—1990***. Helsinki: Kauppiaiden Kustannus.

Jasperson, J., Carte, T. A., Saunders, C. S., Butler, B. S., Croes, H. J. P., & Zheng, W. 2002. Review: Power and Information Technology Research: A Metatriangulation Review. ***MIS Quarterly***, 26(4): 397-459.

Kallenautio, J. 1992. ***EKA in Finland (EKA Suomessa: 128 osuusliikkeestä monialayhtymäksi)***. Helsinki: Tammi.

Kaplan, S., Murray, F., & Henderson, R. 2003. Discontinuities and senior management: assessing the role of recognition in pharmaceutical firm response to biotechnology. ***Industrial and Corporate Change***, 12(203-233).

Kenney, M., & von Burg, U. 1999. Technology, entrepreneurship and path dependence: industrial clustering in Silicon Valley and Route 128. ***Industrial and Corporate Change***, 8: 67-103.

Kimmo, O. 1993. Kun tapahtumakäsittely tuli Keskoon. In M. Tienari (Ed.), ***Tietotekniikan alkuvuodet Suomessa***: 471-475. Jyväskylä: Suomen Atk-kustannus Oy.

Lamberg, J.-A., & Tikkanen, H. 2006. Changing sources of competitive advantage: cognition and path dependence in the Finnish retail industry 1945-1955. ***Industrial and Corporate Change***, 15(5): 811-846.

Langley, A., Mintzberg, H., Pitcher, P., Posada, E., & SaintMacary, J. 1995. Opening up decision-making: The view from the black stool. ***Organization Science***, 6: 260-279.

Lee, S. 1991. The Impact of Office Information Systems on Potential Power and Influence. ***Journal of Management Information Systems***, 8(2): 135-151.

Lehti, M. 1990. ***The formation of resource allocation strategy of the firm and the underlying performance related mechanisms: An empirical study of Finnish consumer goods trade***. Helsinki: Helsinki School of Economics.

Liebowitz, S. J., & Margolis, S. E. 1990. The fable of the keys. ***Journal of Law and Economics***, 33: 1-26.

Lukes, S. 1974. ***Power: A Radical View***. Hampshire: Palgrave.

Mahoney, J. 2000. Path dependence in historical sociology. ***Theory and Society***, 29: 507-548.

Manninen, A. T. 2003. ***Näin tehtiin Suomesta tietoyhteiskunta***. Helsinki: Talentum.

Mitronen, L. 2001. ***Managing of a hybrid-organization: case study of a network organization in retailing (Hybridiorganisaation johtaminen: tapaustutkimus kaupan verkosto-organisaatiosta)***. Helsinki: Taloustieto.

Murmann, J. P., & Frenken, K. 2006. Toward a systematic framework for research on dominant designs, technological innovations, and industrial change. ***Research Policy***, 35(7): 925-952.

Nelson, R. R., & Winter, S. G. 1982. ***An Evolutionary Theory of Economic Change***. Cambridge, Mass.: Belknap Press of Harvard University Press.

North, D. C. 1990. ***Institutions, institutional change, and economic performance***. Cambridge: Cambridge University Press.

Page, S. E. 2006. Path Dependence. ***Quarterly Journal of Political Science***, 1: 87-115.

Peters, B. G., Pierre, J., & King, D. S. 2005. The politics of path dependency: Political conflict in historical institutionalism. ***Journal of politics***, 67: 1275-1300.

Pettigrew, A. M. 1973. ***The Politics of Organizational Decision-making***. London: Tavistock.

Pfeffer, J., & Salancik, G. 1978. ***The External Control of Organizations: A Resource Dependence Perspective***. New York: Harper & Row.

Pierson, P. 2000. Increasing Returns, Path Dependence, and the Study of Politics. ***American Political Science Review***, 94(2): 251-267.

Puffert, D. 2002. Path Dependence in spatial networks: The standardization of railway track gauge. ***Explorations in Economic History***, 39: 143-160.

Robey, D. 1997. The Paradoxes of Transformation. In C. Sauer, & P. W. Yetton (Eds.), ***Steps to the Future: Fresh Thinking on the Management of IT***. San Francisco: Jossey-Bass.

Runko, Y. 1993. Miten elettiin reikäkorttikaudella. In M. Tienari (Ed.), ***Tietotekniikan alkuvuodet Suomessa***: 452-458. Jyväskylä: Suomen Atk-kustannus Oy.

Skurnik, S. 2002. The role of cooperative entrepreneurship and firms in organising economic activities – Past, present and future. ***Finnish Journal of Business Economics***, 1: 103-124.

Teece, D. J., Pisano, G., & Shuen, A. 1997. Dynamic capabilities and strategic management. ***Strategic Management Journal***, 18(7): 509-533.

Tienari, M. 1993. ***Tietotekniikan alkuvuodet Suomessa***. Jyväskylä: Suomen Atk-kustannus Oy.

Tripsas, M., & Gavetti, G. 2000. Capabilities, Cognition, and Inertia: Evidence from Digital Imaging. ***Strategic Management Journal***, 21: 1147-1161.

Veblen, T. 1915. ***Imperial Germany and the industrial revolution***. New York: Macmillan.

Weill, P., & Olson, M. H. 1989. Managing Investment in Information Technology: Mini Case Examples and Implications. ***MIS Quarterly***, 13(1).

Winter, S. G. 2006. Toward a neo-Schumpeterian theory of the firm. ***Industrial and Corporate Change***, 15(1): 125-141.

Yates, J. 2005. ***Structuring the Information Age: Life Industry and Technology in the Twentieth Century***. Baltimore, ML: The John Hopkins University Press.

Zuboff, S. 1988. ***In the Age of the Smart Machine: The Future of Work and Power***. New York: Basic Books.

TABLE 1

Description of the key applications and technologies and their potential impact on power structures between central firm and regions/stores

Application / technology	**Description**	**Possibility of conflicting interests between central firm and regions/stores**
Finance and administration		
Accounting	Financial accounting systems (e.g. book keeping, accounts payable and receivable)	Very low. Administrative system. Affects only centralized processes.
Accounting systems in regions and/or stores	Financial accounting systems for local needs	Low. May require investment (time, money) from regions and stores. In addition, affects the way accounting processes are conducted.
Commercial financial software	Commercial off-the-shelf software for accounting	Low. Administrative system. Affects mainly centralized processes.
Invoicing system	Company level systems for billing the regions and/or stores for the goods sold and delivered	Low. Administrative system. Affects mainly group level processes.
Pay check systems	System for wages calculation	Low. Administrative system. Affects mainly group level processes.
Sales and merchandizing		
Category management	Systems for managing assortments and product mix for the retail chains	High. Regions/stores may anticipate potential loss of autonomy concerning category management.
Customer data management / loyalty program	Systems for managing data on existing customers	High. Loyalty programs may have wide spread impact on several areas of business..
Product pricing (for wholesale sales)	Systems for setting prices for the goods sold and delivered to retail units and/or regions	Low. The central firm, i.e. the group level organization, is responsible for how the wholesale pricing is conducted.

Sales analysis (group level)	Systems for analyzing sales data on company level	Low. The central firm, i.e. the group level organization, is responsible for how the sales analysis on the group level is conducted.
Store level operations		
Order optimization system	Systems that support the evaluation of optimal sizes and frequencies for product replenishment orders	Very high. Regions/stores may anticipate potential loss of autonomy concerning product replenishment.
Point-of sales (1st generation)	First computer-based cash register systems in stores	High. Major investment required, may also impact store level autonomy to manage product data, pricing, etc. However, the first POS investments were often not centrally coordinated.
Point-of sales (in most stores)	Computer-based cash register systems in use in all, or in great majority, of stores	High. Major investment required, may also impact store level autonomy to manage product data, pricing, etc. However, POS systems may still vary from store to store centrally coordinated.
Point-of-sales (common system(s) in all stores)	Unified cash register systems in all stores (systems can be chain / concept specific, e.g. different systems in small grocery stores than in hypermarkets)	Very high. Major investment required, may also impact store level autonomy to manage product data, pricing, etc.
Portable ordering devices	Portable electronic hand held terminals used for sending replenishment orders to warehouses	Low. No major investment required. The objective is purely to make the ordering task more efficient.
Sales analysis (on store level)	Systems for analyzing sales data on store level	High. Provides decision makers detailed information on store level performance.
Space management	Systems for planning optimal layout and shelf space allocation in stores	High. May impact store level autonomy concerning space management.

Store labor planning	Systems for optimizing rosters to better meet demand	Medium. The objective is to optimize store level performance. However, may have some impact store level autonomy concerning roster planning.
Store-level accounting	Financial accounting systems for store level operations	Medium. May impact store level autonomy concerning the finance function and provide decision makers new information on store level performance.
Supply chain		
Automatic replenishment/ sales-based ordering	Systems that create replenishment orders automatically based on reported sales and/or product availability	Very high. Regions/stores may anticipate potential loss of autonomy concerning product replenishment.
Demand planning (on group level)	Systems for forecasting future sales and demand	Low. Affects mainly group level processes.
Direct delivery control (from suppliers directly to stores)	Systems for managing delivery for products that are delivered directly from suppliers to stores (i.e. NOT via distribution centers)	Low. Affects logistics and to some extent store level processes but does not imply loss of autonomy concerning product replenishment.
Product data management (on group level)	Systems for managing common product data	Medium. Concerns the common product data. However, regions/stores may still have separate region/store-specific data bases.
Purchasing	Systems for order entry and sending orders to suppliers	Low. Concerns the overall supply chain but affects mainly group level processes.
Supply management	Systems for managing the supply chain	Low. Concerns the supply chain but affects mainly group level processes.
Terminal management (in central warehouses)	Systems for managing terminal operations in the central distribution centers	Very low. Affects only group level processes.

Transport management	Systems for managing and optimizing transportation of goods	Low. Affects mainly group level processes.
Warehouse management systems (real-time)	Systems for managing inventories and warehouse operations that use real time data on stock	Very low. Affects only group level operations.
Warehouse management (1st generation)	Systems for managing inventories and warehouse operations where stock data is not updated real time	Very low. Affects only group level processes.
Vendor-managed inventory / co-managed inventory (in central warehouses)	Systems where the suppliers take responsibility for maintaining an agreed level of inventory for specific products in the warehouse	Very low. Affects only group level processes.
Voice-directed warehouse system	Systems where warehouse operations, such as storage places, picking orders and routes	Very low. Affects only group level processes.
Infrastructure		
Integrated resource planning system (1st generation)	Integrated cross-functional systems for managing demand and supply of goods	Low. Concerns the supply chain but affects mainly group level processes
Integrated resource planning system (commercial ERP software)	Commercial off-the-shelf enterprise resource planning software	Medium. Concerns the supply chain but affects mainly group level processes. Size of investment may be considerable.
Data terminals in regions	Data terminals that are used for order entry and other data input and output tasks	Low. No major investment required. The objective is only to make the ordering task more efficient.
EDI standard for invoices (company - suppliers)	Electronic Data Interchange between the company and its suppliers where the invoice data in communicated in a specific standard format	Very low. Affects only group level processes.
EDI standard for order data (company - suppliers)	Electronic Data Interchange between the company and its suppliers where the order data in communicated in a specific standard format	Very low. Affects only group level processes.

Electronic data transfer (company - stores /regions)	Electronic data interchange between the company and the stores/regional offices where the data in communicated in a mutually agreed format	Low. Technological issue, does not imply any loss of autonomy concerning store level operations.
Electronic data transfer for invoice data (company - suppliers)	Electronic interchange for invoice data between the company and the suppliers where the data in communicated in a mutually agreed format	Very low. Affects only group level processes.
First computers in use	First computers in the organizations	Very low. First computers acquired for the central firm, i.e. the group level, organization.

TABLE 2

Timeline for IT adoption for key applications and technologies in the organizations

Application / technology	Kesko	OTK	S Group	TUKO
Finance and administration				
Accounting	1968	Early 60's	Ca. 1970	1977
Accounting systems in regions and/or stores	N/A	Late 70's	1973	1977
Commercial financial software	2000	Mid 80's	Ca. 2000	2001
Invoicing system	1964	Early 70's	Early 60's	1973
Pay check systems	N/A	Early 60's	Early 70's	1973
Sales and merchandizing				
Category management	1998	1996	1993	1988)
Customer data management / loyalty program	1996	1993	Mid 90's	-
Product pricing (for wholesale)	1965	N/A	Ca. 1963	1974
Sales analysis (group level)	N/A	Early 70's	Early 70's	1973
Store level operations				
Order optimization system	N/A	Mid 80's	1991	Ca. 1982
Point-of sales (1st generation)	Early 1980's	Late 70's	Late 70's	1985
Point-of sales (in most stores)	Late 80's	1984-1986	Late 80's	Mid 90's
Point-of-sales (common system(s) in all stores)	1995-1998	1984-1986	Late 90's	Mid 90's
Portable ordering devices	1976	1981-1982	Late 70's	Ca. 1980
Sales analysis (on store level)	1983	Late 70's	Late 60's	Ca. 1982
Space management	1993	N/A	1985	1990
Store-level accounting	1993	Late 60's	Ca. 1983	1973
Supply chain				

Automatic replenishment/sales-based ordering	Ca. 2006	2002	Ca. 1998	-
Demand planning	Early 70's	Ca. 1970	70's	Ca. 1982
Product data management	1968	Early 60's	Early 60's	1974
Purchasing	Early 70's	1977	Early 70's	Mid 70's
Supply management	Mid 70's	1979	Late 70's	Ca. 1981
Transport management	Late 70's	Early 70's (punch cards)	Early 80's	N/A
Warehouse management systems, real time	1968	1978	1978	1981
Warehouse management, 1st generation	1964	Ca. 1970	1967	1973
Vendor-managed inventory / co-managed inventory	1990	Late 90's*	Late 90's*	2004
Voice-directed warehouse system	-	2005*	2005*	2005
Infrastructure				
1st generation integrated resource planning system	1983	1977	Early 90's	1981
Commercial ERP software	2003	1996	1997*	2001
Data terminals in regions	1971	1978	Late 70's	Early 80's
EDI standard for invoices (company - suppliers)	1986	1992	1991	N/A
EDI standard for order data (company - suppliers)	Mid 90's	1992	1991	N/A
Electronic data transfer (company - stores /regions)	1964	1979	1978	Ca. 1982
Electronic data transfer for invoice data (company - suppliers)	Mid 70's	1975-76	Mid 70's	Mid 70's
First computers in use	1964	1960	1962	Early 70's

* In Inex Partners

FIGURE 1

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

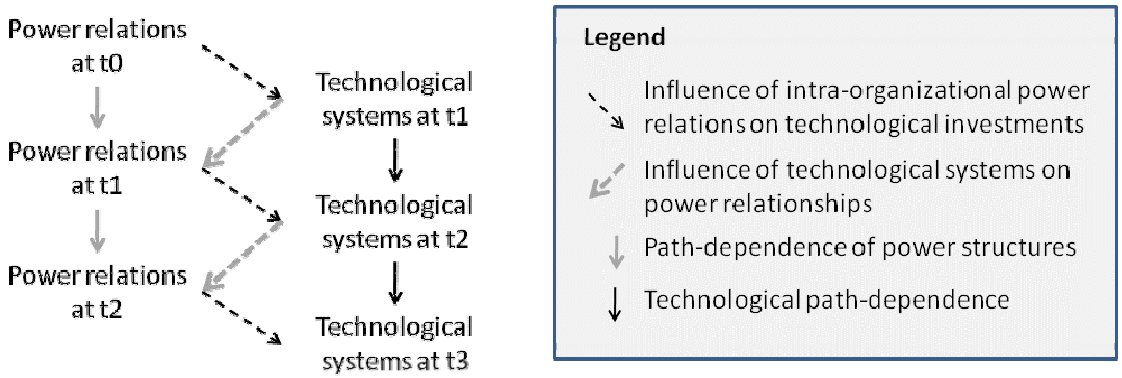

FIGURE 2

Relative focus of executive attention in 1945-2006. Decennial averages. 0=headquarter centered; Above 0=geographic periphery; Below 0=functional periphery. N=2206

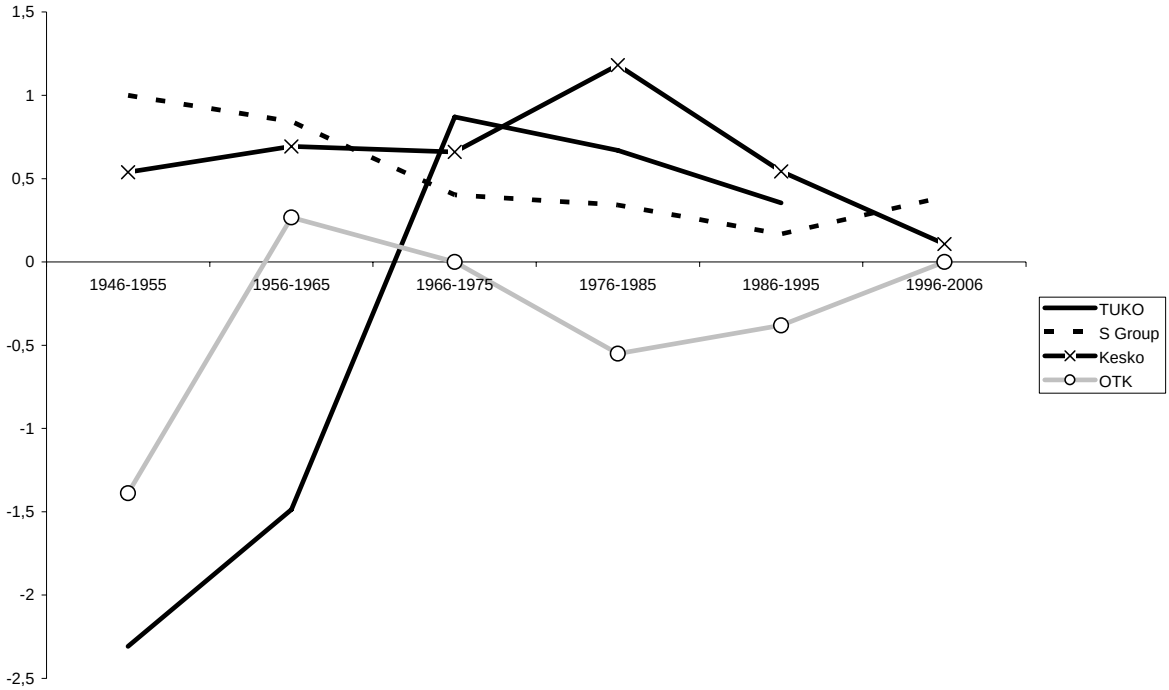

FIGURE 3

Relative ranking of the innovative use of IT as a function of a potential conflict of interests

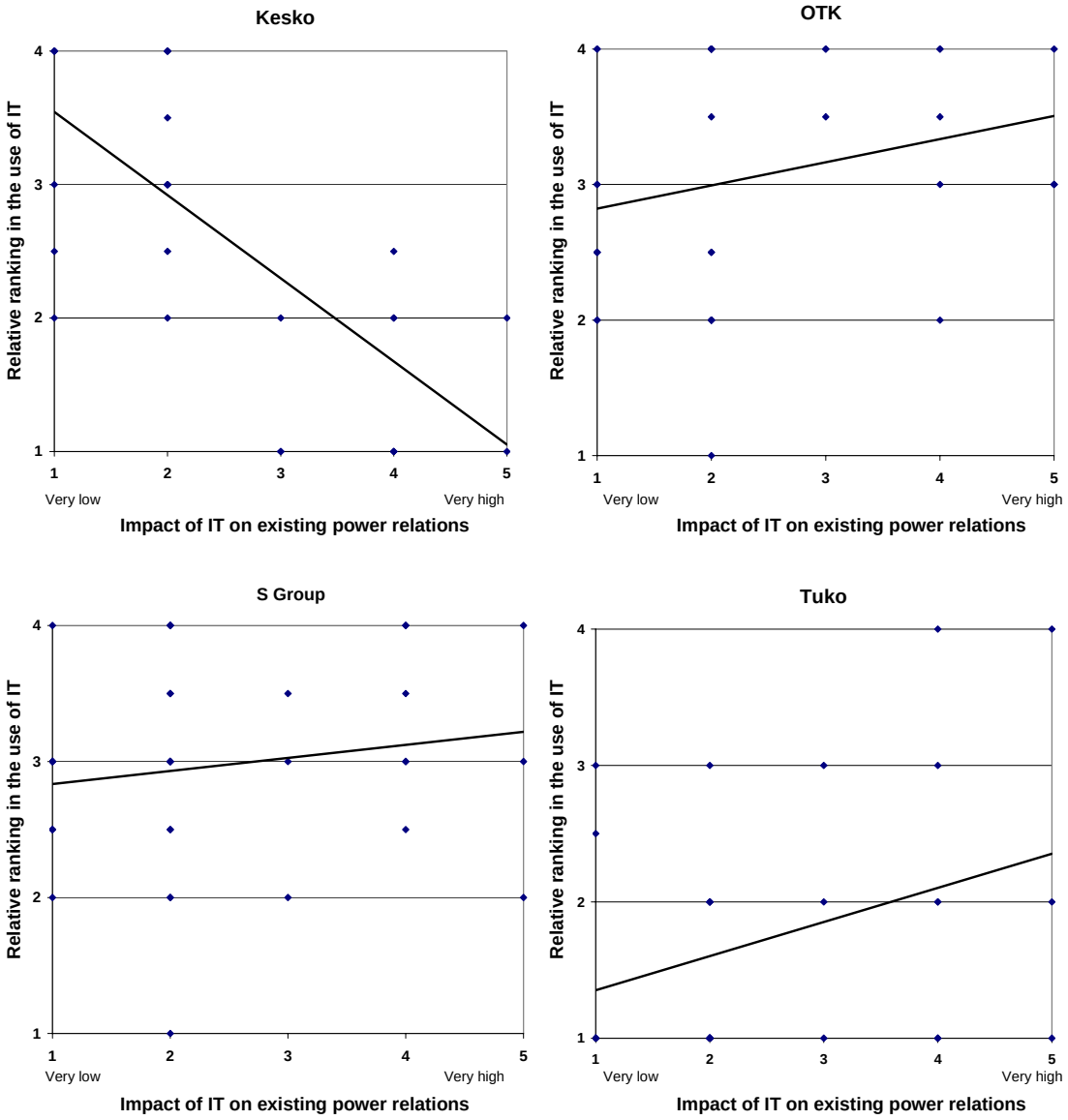

FIGURE 4

Relative ranking of the innovative use of IT in 1960-2005