Evolutionary paths of inter-organizational information systems (IOIS)

Stefan Klein[a], Stefan Schellhammer[a], Kai Reimers[b], Kai Riemer[a]

European Research Center for Information Systems (ERCIS)
Department of Information Systems, The University of Münster,
Leonardo-Campus 3, Münster, Germany
stefan.klein@ercis.de, stefan.schellhammer@ercis.de,
kai.riemer@ercis.de

Research Group on Electronic Business,
Faculty of Business and Economics,
RWTH Aachen University,
Johanniterstr. 22-24, D52062 Aachen, Germany
reimers@wi.rwth-aachen.de

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Abstract

This paper is based on a comparative case study on the development of electronic ordering systems – an example of inter-organizational information systems (IOIS) – linking pharmaceutical wholesalers and pharmacies in Ireland and Australia respectively. Based on a brief account of the market structure we will reconstruct core elements of wholesalers' and pharmacies' strategies with respect to (electronic) ordering and delivery. In order to explain the implementation, enactment and subsequent modification of the wholesalers' strategies in the two countries, we will scrutinize the role of third parties, namely the role of the pharmacy associations and the software vendors. The analysis emphasizes the role of associations and software vendors for the stabilization of the IOIS albeit in markedly different ways. Moreover the role of standards, specifically product codes, and systems architectures becomes obvious. The case studies cover a period of about 20 years and thus allow us to develop explanations for the observed dynamics and stability in a historical perspective. While we have used path dependency theory as sensitizing device for the historical analysis, we have also found shortcomings of its explanatory power regarding mechanisms of stabilization. Hence we suggest to extend the path perspective by a more elaborate study of social dynamics.

Keywords: path dependency, inter-organizational information system (IOIS), pharmaceutical industry

1 Introduction

In this paper we are studying development paths of inter-organizational information systems in the pharmaceutical distribution industry in two different countries. The cross-country analysis has shown that the general idea of eOrdering, which emerged in the 1980s, was implemented in quite distinct ways in Australia and the Republic of Ireland even though some of the actors were aware of the developments in other countries. Instead of one "best practice", different technical and organizational designs were developed and continued to be in use. Moreover the comparison between the cases demonstrates in which way early

decisions shaped and are shaping later developments in the industry. In this regard we will elaborate on the different roles and business models that were consequently assumed by actor groups. The case studies emphasize the salience of 3rd parties such as software vendors or associations. The different ways in which their roles have been enacted had a structuring effect on the division of labour in the industry segment.

Despite the variance across these systems, which have emerged around the same period of time, another phenomenon calls for our attention. Their technical features and organizational set-up partly exhibit a varying, however overall surprising level of stability over time. The Irish system, for example, remained stable for over 20 years by now. While in the Australian case we encountered a variety of heterogeneous electronic ordering devices and systems that are running simultaneously these systems did hardly change over the past 20 years. However, multiple systems are under development at the moment.

The variance across the national systems and their historical origins lead us to suspect that we are confronted with the phenomenon of path dependency. At early points in the history of the cases different development paths have emerged and were subsequently developed. Taking this path hypothesis as a starting point, we need to engage in a detailed case analysis to identify structures that could account for the different routes taken by the industries. In our analysis we will identify critical junctures and strategic moves of the actors that have set the development of IOIS in the industry on different paths. In particular we will reconstruct how actors perceived and enacted technology over time. Thereby, we are striving to uncover stabilizing as well as destabilizing forces.

In the following chapter the theoretical framework is introduced. The third chapter gives a rather high-level comparison of the material and ideational structures in the Australian and Irish case. It also serves as an introduction into the pharmaceutical distribution industry in both countries and introduces respective market structures and the electronic ordering systems in use. In the fourth chapter we will trace back the events that led to the current situation for each of the cases. This serves as a precursor to develop propositions that may explain the different evolutionary paths taken by the two industries. In our conclusion we evaluate the extent to which a path-dependency explanation of the two cases is satisfactory and then identify elements which go beyond a path-dependency framework.

2 Theoretical Framework

eOrdering as it is currently in use in pharmaceutical distribution evolved over more than 20 years. Our first glance observation of the empirical data suggests that the sequence of events is of great importance for the explanation of the current situation.

The emphasis on time or the historical sequence of events suggests the notion of path dependency for our theoretical framework. The theory of path dependency has been developed to explain processes of technology adoption and diffusion where, in spite of an efficient market, an inferior technology prevails (David 1985). By following Pinch (2001) we do not want to restrict ourselves to the analysis of failed or inferior technologies. Instead, it is important that path dependency theory, in contrast to traditional economics, acknowledges that an optimal outcome cannot be guaranteed as well as that it is not precluded.

While the theory of path dependency emphasizes the constraining properties of historical events, in particular lock-in of the actors in e.g. a specific technology (David 1985; Arthur 1989), we would rather take the perspective of path creation (Garud and Karnøe 2001, Windeler 2003). The notion of path creation reconceptualises the actors not merely as lemmings becoming blindly trapped on a path but "knowledgeable agents" (Windeler 2003: 316). Path creation emphasizes the role of human agency in emerging paths. Thereby it tries to scrutinize how actions are constrained and enabled by paths. Actors have an understanding of their environment and what is going on in this environment. Furthermore, agents draw on resources to take influence on processes in their environment. At the same time agents are neither omniscient nor almighty. Their actions have intended as well as un-intended consequences that may contribute to the emergence of a path due to irreversibilities.

From this perspective paths are seen as the result of social action. The emerging idea of eOrdering as an IOIS left room for variation regarding its technical implementation and governance structure. The technical and organizational choices being made are the result of interactions of knowledgeable actors in an organizational field.

The outcome we are observing today is the sum of intended and unintended consequences of ongoing negotiations and decisions over time. The analysis of the roles actors are assuming and the resources they are able to draw upon in the process is therefore a prerequisite for understanding the emergence of a path.

In our analysis we will therefore particularly focus on the different perspectives adopted by the actors. We will scrutinize the strategies actors pursued and the implications on their perception of IOIS. From this point of view the use of technology is shaped by material or physical properties of the artefact itself and the surrounding world (Orlikowsky 2000). The patterns of using a technology may directly or indirectly be structured through regulations existing in its environment. In addition, technology is used by knowledgeable actors whose individual conceptualizations of the world, including the respective technology but also broader strategies, are shaping and are shaped by the technology in use.

Different groups of actors are taking part in the technical system. Each group is characterized by a shared set of beliefs, standards of evaluation and behaviours (Garud and Karnøe 2001:

10). Depending on their perspective on the technical artefact these actors begin to ascribe meanings to it. Actors can try to shape a technological path but at the same time actors are shaped by the path as well (Pinch 2001: 398).

Our case leads us to theorize that the specific actor constellation, their relationships and pursued strategies reveals further insights in stabilizing and destabilizing factors. We therefore do not restrict our analysis to a specific technology as is typically done in the literature (Langlois and Savage 2001: 150). Instead we study technology as embedded in social, economic and regulatory structures.

3 The Irish and Australian pharmaceutical distribution industry

In this section we will give a brief overview of the current market structure and the division of labour in the Irish as well as in the Australian pharmaceutical distribution industry. We will emphasize the role of standards and practices of electronic ordering that have emerged in these countries.

3.1 Method

A case study design has been chosen to conduct the research, because of the complexity of the research question and its focus on a rich real-life context (Yin 2003). In terms of Yin's classification, our cases reveal characteristics (e.g. the industry-wide standard) that are rather unexpected and hence regarded interesting from a research point of view.

The events under consideration are covering a period of time starting in the early 1980s and lasting until today. In regard to the Irish case five semi-structured interviews have been conducted, two with a representative of one of the Irish pharmaceutical wholesalers, one group interview with two leading managers at the Irish body of community pharmacists (IPU), one with a manager of a large software system vendor and one with a representative of a pharmacy chain. In the Australian case nine semi-structured interviews have been conducted, five with representatives of each of the three full-line pharmaceutical wholesalers, two with managers of large software system vendors and two with a proprietor and employee of a pharmacy.

All interviews were tape recorded, transcribed, coded and analysed. The transcribed interview data were evaluated independently by two researchers. A separation of the research team into two groups was geared at increasing objectivity and confidence in the findings (Eisenhardt 1989). All information presented below has been triangulated by at least two interviewees.

Apart from interviews, several other data sources were used; among these are web sites, standards documents, and systems documentations.

3.2 Market structure

We will briefly sketch the current situation on the market for pharmaceutical distribution in Ireland and Australia. The main points of comparison are summarized in Table 1. As pointed out above, the focus of our analysis rests on the electronic ordering systems between pharmaceutical wholesalers and pharmacies. Due to predominantly national regulatory regimes the operations we have studied are confined to national markets. In both countries three nationwide operating wholesalers are supplying the retail pharmacies with the bulk of the needed pharmaceuticals. As full line wholesalers, those companies are providing the full product range sold at pharmacies. In contrast to the Australian legislation ownership of multiple pharmacies is not forbidden in Ireland. As a result of this, pharmacy chains have emerged over the past years. However, in Australia the major part of the independent pharmacies are members of one of several so-called banner groups (essentially marketing groups) which are largely owned by the three wholesalers. Pharmacies are paying a subscription fee to these groups and get support for joint advertising and promotion campaigns. Although massive discounts are provided to members of a banner group by the owning wholesaler there is no contractual obligation to only order from the wholesaler which owns the banner group. The majority of pharmacists is represented by professional bodies the missions of which are to promote economic and professional interests of their members vis-à-vis governments, wholesalers and other organizations.

The Irish market for pharmacy software is divided among three software vendors providing pharmacies with software that incorporates ordering facilities. In Australia a large number of small software vendors are competing. However, the installed base of 4-5 of these vendors accounts for 80-90% of the market for pharmacy software.

	Ireland	Australia
Wholesalers	• 3 full-line, nationwide wholesalers with small variations in market shares.	• 3 full-line, nationwide wholesalers with almost equal market shares (30%). • ~20 small short-line wholesalers with regional focus.
Pharmacies	• ~1400 community pharmacies. • Ownership of multiple pharmacies not forbidden.	• ~5000 independent pharmacies. • Ownership of multiple pharmacies restricted to 4-5 stores.
Pharmacy groups	Chains • ~500 small chains (50% of which consist of 2-4 outlets) • Unicare Pharmacy, the largest chain with today 61 pharmacies, is owned by one of the wholesalers	Banner groups (BG) • majority operated by major wholesalers. • most pharmacies member of BG (subscription-based). • Provide joint marketing and advertising services and discounts vis-à-vis wholesalers.
Pharmacy association	• Irish Pharmacy Union (IPU)	• Pharmacy Guild of Australia, members are owners of 4500 pharmacies (2008)
Products	• 8.000 licensed prescription medicines (pharmacy-only), 75% of sales. • Non-prescription medicines (OTC) • Cosmetics, Toiletries, Sundries (CTS)	• 2600 Prescription medicines (pharmacy-only), 60% of sales. • Non-prescription medicines (OTC, pharmacy-only), 10% of sales. • Cosmetics, Toiletries, Sundries (CTS), 25% of sales.
Software Vendors	• 3 software vendors with varying market shares (55%, 40%, 5%)	• ~20 software vendors • 4-5 largest software vendors have ~90% market share.

Table 1: Comparison of the Australian and Irish pharmacy markets

Pharmacy business models

In Ireland, GPs decide about the prescription medicine to be provided by a pharmacy. In Australia the patient may require the pharmacist to provide a cheaper generic instead of a brand name product in order to save on co-payments. In both countries the availability of medicines is a crucial element of customer satisfaction. Australian pharmacists would try to borrow out-of-stock pharmaceuticals from neighboring pharmacies in order to satisfy customer needs. Pharmacies in both countries can rely on fast delivery cycles of up to two deliveries per day by each of the wholesalers. Margins are fixed as a mark-up on the wholesale price. For pharmaceuticals dispensed under a reimbursement scheme, pharmacies in both countries are receiving fixed dispensing fees. Furthermore they are permitted to sell non-pharmaceutical products at higher margins.

Swift deliveries by the wholesalers allow pharmacies to operate on rather low stock levels. In Ireland as well as in Australia pharmacies would use one wholesaler as a primary supplier and a second one as a fall-back. In Ireland, the dependency on the primary wholesaler is lower while they often also use a third one. The loyalty of pharmacies to a particular wholesaler in

Australia is partly due to loan guarantees during the start-up of a pharmacy and its affiliation to a particular banner group. Pharmacists in both countries avoid a lock-in to one wholesaler and are rather trying to find the best deals available in the market.

Wholesaler business models

In both countries, the three major wholesalers are operating as nationwide full-line suppliers. While there are differences in size, the wholesalers operate in the same size class. Even though manufacturing prices and wholesale margins are fixed, there is still price competition among the wholesalers, who pass on a part of their margins to the pharmacies via discounts, bonus schemes and other price incentives.

The wholesalers in both countries are competing for their customers' loyalty in order to become pharmacies' preferred suppliers. Wholesalers in Australia used to help pharmacists to start their business by providing loan guarantees. Consequently pharmacists often felt obliged to order the majority of supplies from that wholesaler. Today the provision of loan guarantees as well as customer loyalty is decreasing. All three Australian full-line wholesalers own banner groups. From a wholesaler's perspective these are perceived as an instrument to retain some measure of customer loyalty although member pharmacies are not obliged to order from the owning wholesaler. In both countries the quality-of-service is an important consideration of pharmacies. Fast order-delivery cycles, few stock-outs and immediate feedback to the pharmacists in case of a stock-out constitute the quality-of-service from a pharmacist's point of view.

The three Australian wholesalers emerged through several mergers and acquisitions. Today, one of them owns one of the manufacturers of generics. A second wholesaler bought a retail chain and the third is the largest shareholder of one of the pharmacy software vendors. In 2003 the commonwealth government reduced the wholesalers' margin from 10 to 7.5%. At the same time it offered 150 million AUD p.a. in compensation to be divided amongst the three full-line wholesalers due to their special commitment to deliver any prescription drug within 24 hours at a fixed price to any community pharmacy.

Software vendors

The Irish market for pharmacy software is split between three vendors. The vendor with the smallest market share (~5%) has been founded by a group of pharmacists in response to the consolidation of the market.

In Australia around 20 vendors are competing with different regional focuses. Most of them emerged from initiatives brought forward by single pharmacists. However the largest 4-5 software vendors together make up 90% of the market. The largest shareholder of one of the biggest software vendors is the Pharmacy Guild of Australia. The pharmacies are charged a

monthly fee for support and maintenance work. One major maintenance task is changing and reconfiguring the protocol gateways to the wholesalers. Since there are no common standards, the IT suppliers have to amend the protocols and gateways whenever one of the wholesalers makes any changes to their protocols or data standards. One major problem is that in such an event, the IT suppliers have to make changes to the software and redistribute the new version to every site where it is used in the market place. Some vendors developed a distribution method via Internet dial-up connections, others still send out floppy disks.

3.3 Electronic ordering standards and practices

Today pharmacies in both countries are able to order via several channels from their suppliers. In addition to ordering via telephone or fax pharmacists may order from sales representatives of the manufactures and they may use eOrdering facilities to order directly from the wholesalers. All of these channels are depicted in Fig. 1 for the Australian as well as for the Irish case.

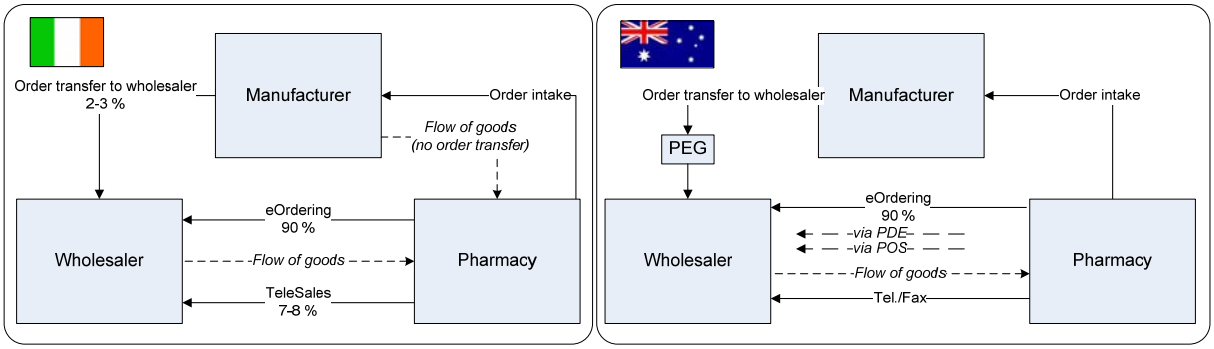

Fig. 1: Ordering facilities

Electronic ordering nowadays accounts for nearly 90% of all orders reaching the wholesalers. Although this is true for both countries we will show later on that the situation is not as similar as it seems. In Ireland pharmacies are phoned on a daily basis by dedicated staff on behalf of the wholesalers. This is done in order to maintain a personal relationship, to do some promotions and to obtain market intelligence.

In Australia pharmacies are using phone calls or fax in order to ask whether some pharmaceuticals are in stock before placing their electronic orders. The majority of orders taken by sales representatives of manufacturers are passed on to the wholesalers. This is done in the Australian case via dedicated software that serves as a hub for all wholesalers. This hub has been developed and is operated jointly by all wholesalers. Handheld computers (so-called PDE device) enabled pharmacies to order from their wholesaler electronically. It still operates the same way as it did when it was introduced in the 1980s. The pharmacist uses the handheld device to scan a barcode that is attached to the shelf. This barcode is used to identify the product in the electronic order message that is send to the wholesaler. The devices are lent to

the pharmacies by the wholesalers. Each device can only be used to issue orders to a specific wholesaler. The barcode represents the product number that has been assigned to the product by the wholesaler. Each wholesaler administers its own product numbering scheme. After having scanned the product barcode the pharmacist enters the number of products to be ordered into the device. The order is sent via a modem dial-up connection to the wholesaler. The pharmacy software provides, besides other functionalities, the possibility to order electronically via modem connections as well. Although each wholesaler maintains its own numbering scheme and order protocols the software can route orders to each of the wholesalers and partly also to some short-line suppliers. This is done through internal mapping of the order message and the product identification codes. For this purpose the software vendors are maintaining cross-reference tables to ensure a smooth mapping.

In Ireland pharmacists can order with their pharmacy software from each of the wholesalers. Although electronic orders can be easily switched from one wholesaler to another in both systems, the processes differ significantly from a technical point of view. Order messages, protocol and product codes are standardized across all wholesalers. Therefore software vendors do not have to maintain redundant ordering modules for each of the wholesalers. Instead one ordering module can be used for issuing orders to each of them.

4 The history of IOIS

We have traced the events leading to the emergence and development of the IOIS since the 1980s. In this section we will briefly recapitulate the sequence of events that happened in both countries.

4.1 The Irish story

Our report of the Irish case and the events that led to the current situation is structured along four periods that we deem critical with hindsight.

Looking for change – mid 1980s

The events leading to the development and emergence of the eOrdering systems can be traced back to the 1980s. In this period wholesalers were actively looking at innovative and strategic solutions to facilitate (electronic) ordering. For example United Drug (UD) studied the example of eOrdering systems in the US (McKesson, see (Johnston and Vitale 1988)) and intended to adapt such solutions to the Irish market. The US example was perceived as a means to reduce transaction costs (manual, error-prone order intake) and thereby streamline processes in order to become more profitable. Furthermore a proprietary solution, as was found in the US, would have conformed to the strategic rationale to lock-in pharmacies and subsequently increase market share. Our data indicate that such a proprietary solution was

regarded beneficial by other actors in the wholesaling business as well. Due to different market regulations, UD decided to develop a new solution from scratch together with software vendor McLernon, which was introduced in 1986. At that time the Irish market for pharmacy software was perceived as a "virgin market", meaning that typically pharmacies would not have any IT-equipment installed. Initially the system put forward by UD was designed to use wholesaler specific product identification codes that were already used in the UK. A new product identification code was necessary because not all products had a manufacturer barcodes at the time.

Creating a path – Adoption and diffusion phase 1986 – mid 1990s

The Irish Pharmaceutical Union (IPU) was aware of the intentions of the wholesalers and intervened at an early stage to prevent the development of proprietary ordering systems. The main reason behind this intervention was that the IPU wanted pharmacies to retain their ability of unrestrained order routing. A proprietary, mutually incompatible solution was perceived as running counter this interest. As a result of this the IPU facilitated negotiations among all wholesalers to develop common ordering standards. In order to overcome proprietary numbering systems the IPU engaged in negotiations with EAN UK to be allocated batches of numbers. Eventually the IPU was granted manufacturer status by EAN UK which enabled the IPU to assign its own EAN-conforming numbers to all products sold in an Irish pharmacy. This precedence triggered the whole standardization process and provided a clear signal for the negotiations with the wholesalers.[1] The negotiations took place only between the wholesalers and the IPU. However, the software vendors attended the meetings as well in order to make sure that outcomes would be feasible. The agreement that was finally reached comprised the order protocol including message types, a product file and the product identification code.

The *order protocol* specifies the syntax rules independent of machine or system of sender or receiver. The maintenance and documentation is carried out by the IPU. The wholesalers receive orders via a modem connection and reply with a back list of unavailable items and granted bonus items. This back list can then be turned into a new order to another wholesaler.

The *IPU product key* identifies all products sold in an Irish pharmacy. The manufacturers report any new product to the IPU which is in charge of assigning codes to new products. A list containing all product codes is distributed by the IPU via the IPU product file.

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[1] Several people within UD had also actively promoted a standardized solution as more beneficial for the pharmacies and eventually also for the wholesalers.

The *IPU product file* is an early version of a data pool across multiple suppliers. In addition to the product key it categorizes products, includes manufacturer EAN-codes, codes used for reimbursement and dispensing information for the pharmacist.

Diffusion and stabilization of the eOrdering-standards

The diffusion of the eOrdering systems happened gradually over a ten year period. This can partly be explained by the lack of a technological infrastructure on behalf of the pharmacies. In addition the pharmacies initially perceived that all benefits mostly accrue to the wholesalers. The wholesalers responded with small discounts for electronic orders. All software vendors implemented the common standards. Due to new entrants the software vendors were facing fierce competition which, in turn, resulted in a continuous stream of new software features for Irish pharmacists. Today, all pharmacies are able to order electronically. The eOrdering module built into pharmacy software has become a “must have feature”. The product file has become a cornerstone of pharmacy practice as well in regard to counseling patients and for processing reimbursement data. Furthermore, the GMS Board, which is in charge of reimbursing pharmacies for medicines dispensed under the state-administered schemes, uses it to look up prices by. Pilot projects are underway to use the system in hospitals and surgeries. The standards are tightly integrated into wholesalers’ systems as well. The information coming in via the order module is directly feeding their picking&packing systems. From an organizational point of view, the wholesalers have adapted to the eOrdering solution by assigning a new task to their telesales–staff. Their task shifted from formerly order taking to doing marketing, promotions and customer relationship management.

The IPU has taken over the role of a standard custodian by setting up an organizational unit to maintain and update the product file. The product file and codes have become crucial for the IPU because it is only distributed to its members. Nowadays, this constitutes a major reason for pharmacies to become member of the IPU or to retain their membership. This, in turn, provides the IPU not only with funding but also adds legitimacy to its role as the representative body of Irish pharmacies. Extending the area of application of the standards further stabilizes its roles.

4.2 The Australian story

The Australian case starts around the same time as the Irish one. We have structured our report around the introduction of new eOrdering systems. As several systems from various vendors entered were offered on the market our report only covers the introduction of systematically different systems.

Introduction of the PDE – mid 1980s

Starting in the mid 1980s the wholesalers one by one introduced PDE devices to enable pharmacies to order electronically. It was introduced to the market as a premium service for valued customers of the wholesalers. The wholesalers provided and still provide the hardware. Their staff also cares for maintenance in terms of hardware errors and up-to-date product files. The PDEs can be used to order from only the providing wholesaler due to the proprietary numbering systems and message protocols. The communication with the wholesaler system is done via a modem dial-up connection. Pharmacy staff walk along the shelves and scan the wholesaler barcodes. This information is then used to issue an order when the device is put back in its cradle. Using the PDE devices requires the pharmacist to ticket their shelves with wholesaler-specific barcodes and has a lock-in effect. However, wholesalers would actually carry a major part of the switching cost and help pharmacists to re-ticket their shelves in case pharmacists wanted to switch to another supplier. This typically takes about a day.

POS eOrdering - mid 1990s

From the late 1980s to the mid 1990s software vendors started to develop POS systems for pharmacies. These vendors often emerged from the pharmacy sector itself and served only a small community of pharmacies. Due to customer requests they soon had to implement the different order protocols and message types of each of the wholesalers. Furthermore, product codes had to be converted internally. This required the system vendors to constantly keep cross-reference tables up-to-date. From a pharmacy perspective, these systems would enable the seamless switching of orders from one wholesaler to the other. After an order is entered into the system the order message is transferred to the wholesaler systems via modem connection. Invoices are sent during the next time the wholesaler logs on to the pharmacist's system. Most pharmacy software incorporates modules to store the sales history of products. This can be become a major obstacle for pharmacies willing to change their software system because the quality of conversion is directly dependent on how well the vendor has maintained the data. Today some vendors are licensing their cross-reference data to other software vendors. This has become a new business for the respective players. The establishment of a cross-reference table furthermore requires the software vendors to assign their own codes as primary keys to map the wholesalers' codes.

Another round of initiatives since the late 1990ies

In the late 1990ies, initiated by the government, the wholesalers developed the so-called Pharmaceutical Extranet Gateway (PEG). Its aim was to connect the three full-line wholesalers with their suppliers and customers. Around 60 suppliers are currently using the system to communicate with the wholesalers. For the latter this accounts for 70% of their order value. The PEG is jointly controlled by the wholesalers which are paying subscription

fees to an administrating IT-vendor. Not only are the orders being issued by the wholesalers transferred via this system but also the so-called turnover-orders that are created by manufacturers' sales representatives at the pharmacy's premises. Although technically feasible and originally intended this system was never opened for use by pharmacists. This was mainly due to the opposition of the wholesalers.

A few years into the new century, a new South African software vendor entered the market and formed a joint venture with Cosmos, one of the largest software vendors for pharmacy software. Based on a technology that was developed in South Africa they planned to provide an order exchange system between the pharmacies and all Australian wholesalers. This initiative, however, failed quickly as the joint venture did not command sufficient market power in terms of installed software and the wholesalers were not supporting it. The reason for this lack of support was that the technology brought from South Africa was built to offer the pharmacists direct price comparisons. This was opposed by all wholesalers. Their entry into the market alerted the other software vendors and triggered a new Australian, "home grown" initiative. Led by NU Systems, the four largest software vendors joined forces in the PharmX or Pharmacy Exchange initiative. The initiative is open to any supplier and any IT vendor. It is intended that orders from pharmacies are transferred via Internet connection to a central server that is able to communicate with all three wholesalers' systems by using new Web Services. The aim is to replace the old modem-based connection by the Internet. This is partly triggered by the ever decreasing level of hardware support for the old technology. Furthermore, the software vendors aim to decrease the costs of maintaining heterogeneous order protocols by referring to PharmX as clearing center. A server would encapsulate the proprietary order protocols of the wholesalers at one central hub. Software updates and modifications regarding these would therefore only be needed for the server. Hence, the n-m-o connections would be transformed into a hub-and-spokes architecture (n-1-m). Each wholesaler would have to pay a subscription fee based on the monthly transactions coming in via PharmX. The revenue for the software vendors would be based on the number of pharmacies using a PharmX connection. At the time when these interviews were conducted the software was in a prototype stage and negotiations with the wholesalers under way. The effort to introduce Internet technology to the industry is backed by a governmental initiative to promote the diffusion of broadband connections among pharmacies.

Meanwhile most wholesalers have introduced ERP-systems and are trying to make use of their functionalities. One of the wholesalers has introduced a web-based ordering platform for use by pharmacies.

5 Comparison and discussion

Fig. 2 juxtaposes the events in both countries as described in the previous section along a timeline.

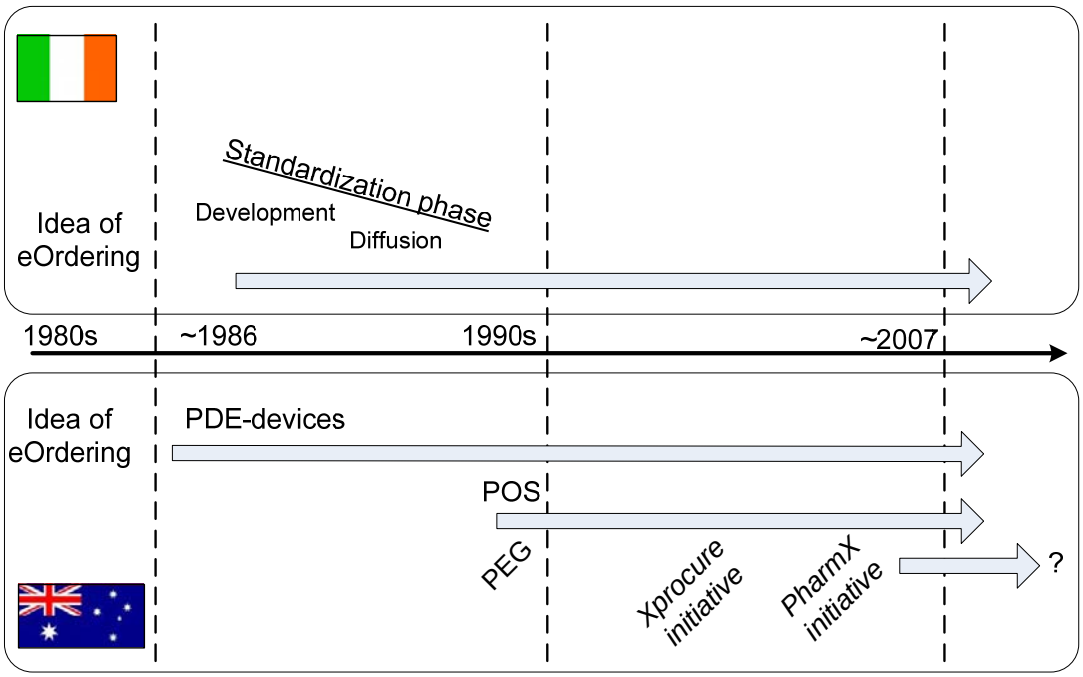

Fig. 2: Development of eOrdering-systems in Australia and Ireland

5.1 Making sense of the Irish development

The historical analysis provides evidence for a development pattern which looks like a path (path hypothesis); however to actually establish a path on theoretical grounds is more difficult. Our case analysis does not suggest a single factor which would provide a strong lock-in, rather we found a unique actor constellation which mutual reinforces or stabilizes the relationships and practices in the industry segment.

From a *strategic point of view*, the **wholesalers** decided – influenced by the IPU and probably also pharmacies, who held shares of wholesalers – to jointly develop standards for eOrdering. This decision runs counter to the common recommendation to use IS strategically in order to achieve a competitive advantage. In hindsight, it appears that the quite limited scope of the joint activities has been wisely chosen. In effect a relatively small area has been exempt from competition and in turn has lead over time to the development of highly efficient, industry wide ordering practices within the defined model of division of labor. From a technical perspective, it provides a common, predictable basis for system development and restricts wholesalers' lock-in maneuvers, yet it provides ample space for systems-based competition among **vendors** for pharmacy or wholesaler systems (as long as they adhere to the common standards) which seems beneficial particularly in a small market. As a result, the **pharmacies**

adopted the solution quickly, benefited from the operational efficiencies of standardized electronic ordering, including order splitting. The diffusion of the standards clearly yielded positive network externalities and in turn increased the costs for alternative solutions. Moreover, eOrdering stabilized delivery (and stock-keeping) practices to the advantage of the pharmacies.

The successful standardization in turn provided ample scope and opportunities for strategic differentiation in other areas. Some wholesalers, e.g., used personalized (tele) sales channels to retain the direct contact to their clients and optimized warehousing and distribution. The pharmacies put more emphasis on POS systems and practices of consulting patients.

While the buyer – seller relationship is at the core of our analysis, the empirical data underline the key role of the IPU and a minor role of the system vendors. The **IPU** naturally used the role as the main pharmacy representative body and adopted the role of standard custodian; this reinforced their role and stance in the industry. It acted as intermediary between wholesalers and pharmacies that bundled the power of the otherwise fragmented pharmacy segment.

In sum, we see two interrelated threads of arguments: One is the successful initiation, development and indeed diffusion of standards in an industry segment. The other is an actor constellation and related field of converging forces, reinforcing the chosen standards by different actors and for different strategic reasons. Initially competitive approaches by the wholesalers were confined by pharmacies and the IPU and even among the wholesalers some pointed out the benefits of a standardized solution specifically for the Irish market.

The core of the eOrdering solution has remained quite stable despite occasional challenges over the past years. Yet we see a number of trends which might lead the wholesalers or pharmacies to reconsider their eOrdering practices: Reimbursement for both pharmacies and wholesalers has been reduced by the government, challenging the economic rationale of the existing modus operandi. The IPU has provided their standardized product data also to pharmaceutical manufacturers thus facilitating a trend towards direct sales to pharmacies and bypassing of wholesalers. Moreover, the texture of the industry appears to be changing in response to regulatory changes and probably broader economic trends. CMR, a wholesaler which is part of the European Celesio Group, took over of Ireland’s largest pharmacy chain (Unicare Pharmacy) in 2002. While this has not led to immediate changes of the eOrdering practices, it clearly shows alternatives for tighter integrated warehousing and distribution practices, e.g. based on continuous replenishment or collaborative planning and forecasting. Together these forces might yield more profound transformations in the relationships between pharmacies and wholesalers and the eOrdering practices.

5.2 Three Australian Paths?

In the Australian case we are confronted with a multiplicity of different electronic ordering facilities. In contrast to the Irish case the once adopted proprietary numbering systems and ordering protocols of the wholesalers have prevailed over the years and thereby resemble in themselves three potential paths. Compared to the Irish case a completely different actor constellation has evolved. Our findings suggest that strategic moves of actors in the beginning account for the differences between the cases.

Arguing again from a *strategic point of view* the Australian **wholesalers** decided to pursue competitive strategies with regard to eOrdering devices and standards in the very beginning. Their strategic use of IS was aimed at increasing customer retention by raising switching costs and thereby establish customer lock-in to their systems.

Different arguments can be brought forward to explain the initial strategic choice of the Australian wholesalers to compete on these grounds. First, an explanation may rest on the contingencies of the time. Second, each of the wholesalers has a different venue and strategic orientation of its business. As pointed out in section 3.2 the wholesalers' company history and fields of business activity were rather widespread and heterogeneous. Despite the pharmaceutical wholesale business, companies engaged in running hospitals, pharmaceutical manufacturing and software development. This heterogeneity among the actors may have prevented collective action at an early stage because of diverging interests and priorities. Third, we have demonstrated the important role of the IPU in the Irish case. Our data does not reveal any actor (e.g. **Pharmacy Guild**) in the Australian case that has assumed a similar role. Today the wholesalers do not perceive the once intended technical lock-in to persist. Pharmacies can easily switch between each of them. As a response to the dwindling customer loyalty wholesalers moved their strategic focus from technical standards to franchise concepts that are intended to bind their participants more closely to one wholesaler. Today each wholesaler owns several banner groups in which a large number of pharmacists are paying and more importantly "loyal" members.

After the introduction of proprietary ordering systems the Australian **pharmacies** similar to the Irish wanted to regain their freedom of order routing in order to take advantage of price differences. **Software vendors** satisfied this need by making the different order protocols transparent from a pharmacy's point of view. Thereby they created a functional equivalent to the Irish system. As a result of this Australian pharmacies were enabled to easily switch their orders from one wholesaler to the other. Thus, the strategic move of the wholesalers was obliterated. The wholesalers did not refrain from their proprietary ordering standards due to legacy systems and a large installed base. Hence they forced the software vendors to continuously maintain and administer cross-reference tables as a hidden service that allows order switching for their customers. This task became a valued service and business between

the software vendors themselves. The costs for the integration of incompatible, proprietary ordering standards are borne by the software vendors and, indirectly, pharmacies. This in turn created common ground for the software vendors to suspend competition on implementing the different ordering protocols. This recent strategic move aims at establishing a joint clearing center (PharmX) that would serve as a central translating device between different wholesaler systems. Depending on the number of software vendors joining the initiative they may create a political equivalent to the IPU. That means a power balance between wholesalers and software vendors may develop.

The PharmX initiative tries to merely ease the burden of the software vendors but does not eliminate the different product codes and ordering protocols. Instead it seems that these are preserved since their invention in the early 80s and have become a structural aspect of the IOIS of the industry.

Until now, the indirect involvement of the pharmacy guild, the fear of lock-in and possible price comparisons made the wholesalers reluctant towards joint initiatives. The absence of initiatives on behalf of the wholesalers to overcome the proprietary standards seems to result out of the legacy systems that have to be kept operational due to a large installed base. From a wholesaler's perspective there is no economic incentive to invest into new product codes and order protocols that pay off the sunk costs. Especially in the case of product codes the burden of handling the heterogeneity among the wholesalers is transferred to the software vendors. Pharmacies would thus not pressure the wholesalers to overcome these.

Coming back to the initially phrased path hypothesis, we conducted a historical reconstruction of the developments of eOrdering in Australia. Instead of one system or one set of standards we observed the emergence of multiple proprietary standards and a variety of ordering facilities. The market seems to be vibrant, in flux and more innovative compared to the Irish. However the initially introduced proprietary product codes and ordering standards prevailed throughout the last twenty years. Actors were not able to shake free of these. They seem to be inscribed into the industry and having a structuring influence on emerging systems. Therefore one could argue that in Australia, several paths emerged and were pursued. In our analysis we tried to explain the development of eOrdering systems from a path dependency perspective. In conclusion we have to admit that path dependency alone does not provide sufficient arguments to explain satisfactorily the situation found in Australia. However we do find that the historical perspective put forward by path dependency does reveal incidents that exert an important influence on later stages of the development. Hence, we argue that a path dependency informed analysis has its merits but needs to be set on a richer theoretical basis.

5.3 Synopsis

Table 2 provides a synopsis of the rationales of the key players, the roles of intermediaries and the outcomes.

	Ireland	Australia
Wholesalers' strategic rationale	Differentiated approach towards standardization and use of eOrdering: core standards around which differentiated systems and practices have been built.	Competitive approach towards eOrdering: three different proprietary solutions emerged. Creating Banner Groups to support joint marketing activities and efficiency gains of pharmacies.
Pharmacies' rationale	Explicit wish to perpetuate order-splitting also in a new electronic ordering regime. Initial expectation that eOrdering benefits would be divided unevenly (to wholesalers') advantage, eventually replaced by acknowledgment of own benefits, reinforced by emerging delivery practices.	Maintaining order-splitting despite competing order systems and banner groups.
Role of third parties	Crucial role of IPU during the development and maintenance of the standards. Software vendors have all accepted and implement the eOrdering standards and differentiate their solutions in other domains.	No direct role of pharmacy guild in the development of eOrdering solutions. Indirect role through support of one of the systems vendors. Systems vendors acknowledge pharmacies' interest in order splitting and have created "clearing centers" to facilitate order forwarding and translation of product codes across wholesalers.
Dynamics of systems	Stable core due to power balance and network externalities. Wholesalers cannot act unilaterally, without reverberations to their client base. Changes in all other parts/ functional domains of the systems.	Strategic differentiation and opportunity to act unilaterally lead to several changes of the technical infrastructure for eOrdering over time. Several attempts to overcome fragmentation on the product code level.

Table 2: Comparison of the Australian and Irish eOrdering solutions

6 Conclusions

The notion of path dependency has been applied to various fields. Originally used to explain adoption and diffusion processes of (inferior) technologies (David 1985, Foray 1997, Pierson 2000) the concept has been transferred to institutions (North 1992, Ackermann, Mahoney 2000) as well. A large variety of mechanisms have been proposed by authors to account for stability or continuity of an observed object (Beyer 2005). In this regard it seems to be difficult to speak of a theory of path dependency. Rather the notion of path dependency is used as a theoretical perspective that sensitizes the researcher for the historicity of events, artefacts and stabilizing mechanisms.

In this paper we set out to account for the stability and variance of electronic ordering systems in Ireland and Australia. In particular we reconstructed their historical development and looked for stabilizing mechanisms as evidence for a path. However, we did not find a single or universal stabilizing mechanism in the sense of the path dependency literature (Beyer 2005). Instead we argue that a web of stabilizing and destabilizing forces related to the actor constellation is constantly evolving. Our findings emphasize the fragility and dynamics of stability.

Scrutinizing the path hypothesis has turned out to be quite challenging in terms of narrowing down what constitutes a path in each case. We used the term IOIS rather broadly. Thereby it incorporates technical features, relational aspects and practices of using the system. In both cases the set of standards (product codes, order protocol) has remained stable over the years. The different nature of these standards (proprietary vs. common) revealed a structuring influence on the IOIS as a whole. It seems that these standards like a stable core set the stage for different strategic games of the actors, thereby influencing practices and interorganizational relations alike.

In the previous section we identified endogenous (Irish case: pharmacy chains) as well as exogenous (regulation) destabilizing forces that may alter actors' strategies in the future and thus impact on the IOIS. We would therefore reject the notion of "lock-in" as it implies the long term effect of a stabilizing mechanism. Our findings suggest that such an explanation falls short in regard to the constantly contested and reproduced aspect of the systems that we studied. In this sense we argue that the concept of path dependency needs to be enriched by incorporating theories focusing on routines and practices.

The currently observable system emerged as a result of a complex interplay between unilateral as well as multilateral strategic choices and their intended and unintended consequences. These consequences result from reactions and responses of the actors that experience a structural change in their interorganizational relationship. In the Australian case this complex interplay of action and reaction to strategic manoeuvres is still vibrant. The momentum seems to be passed on from one actor to the other. In contrast, we observed a rather long period of calmness in the Irish case. The chosen solution seemed to suit the actors. In this regard the Irish case seems like a sleeping volcano compared to the more active Australian one. This however does not imply that it may not break out in the future as we already identified cracks under the surface.

Our findings suggest that in order to reach an equilibrium of stabilizing and destabilizing forces, the structural aspects of a system need to resonate in harmony with actors' practices. Hence, a system is not simply adopted or rejected but needs to become atuned to organizational practices. If this is not possible (anymore) to a certain extent actors will become agents of change, thereby adding to the fragility of stability.

In order to research the cases from this perspective, a different theoretical basis is needed than the one adopted throughout this paper. As pointed out the resonance between systems design and practices needs to be explored. Practices are shaped by and are shaping structures. Ideational, institutional as well as material structures seem to be equally important to understand the strategic choices of the actors in the past and their influence on later developments. Such a theoretical framework may shed light on the social aspect of socio-technical systems which seems to be equally important.

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References

Ackermann, Rolf
2001 Pfadabhängigkeit, Institutionen und Regelreform. Die Einheit der Gesellschaftswissenschaften, 120. Tübingen: Mohr Siebeck.

Arthur, W. Brian
1989 ‘Competing technologies, increasing returns, and lock-in by historical events’. The Economic Journal, 99(394).

Beyer, Jürgen
2005 ‘Not All Path Dependence Is Alike – A Critique of the “Implicit Conservatism” of a Common Concept’. Zeitschrift für Soziologie, 34 (1): 5-21.

Cusumano, Michael A., Yiorgos Mylonadis, and Richard S. Rosenbloom
1992 ‘Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta’. The Business History Review, 66(1): 51–94.

David, Paul A.
1985 ‘Clio and the economics of QWERTY’. The American economic review, 75(2): 332–337.

David, Paul A.
1997 ‘Path Dependence and the Quest for Historical Economics: One More Chorus of the Ballad of 'QWERTY', University of Oxford’. Discussion Papers in Economic and Social History, 20

David, Paul A.
2001 ‘Path dependence, its critics and the quest for 'historical economics''. Evolution and path dependence in economic ideas, 15–40.

Eisenhardt, Kathleen M.
1989. ‘Building Theories from Case Study Research’. The Academy of Management Review, 14(4): 532–550.

Fingleton, John, Declan Purcell, and Isolde Goggin
2002 Report of Investigation: Competition Authority (pp. 1–64). Retrieved Jul 16, 2007.

Foray, D.
1997 ‘The Dynamic Implications of Increasing Returns: Technological Change and Path Dependent Inefficiency’. International Journal of Industrial Organization 15: 733-752.

Garud, Raghu and Peter Karnøe
2001 ‘Path Creation as a Process of Mindful Deviation’. In R. Garud, and P. Karnøe (Eds.), Path dependence and creation, 1–38. Mahwah N.J.: Lawrence Erlbaum Associates.

Johnston, H. Russel, and Michael R. Vitale
1988 ‘Creating Competitive Advantage with Interorganizational Information Systems’. MIS Quarterly, 12(2): 153–165.

Langlois, Richard N. and Deborah A. Savage
2001 ‘Standards, Modularity, and Innovation: The Case of Medical Practice’. In R. Garud, & P. Karnøe (Eds.), Path dependence and creation, 149–168. Mahwah N.J.: Lawrence Erlbaum Associates.

Mahoney, J.
2000 ‘Path Dependence in Historical Sociology’. Theory and Society 29: 507-548.

North, Douglass C.
1990 Institutions, institutional change, and economic performance. The political economy of institutions and decisions. Cambridge, New York: Cambridge University Press.

Orlikowski, Wanda.
2000 ‘Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations’. Organization Science 11 (4): 404-428.

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

Pinch, Trevor
2001 ‘Why do you go to a Piano Store to Buy a Synthesizer: Path Dependence and the Social Construction of Technology’. In R. Garud, & P. Karnøe (Eds.), Path dependence and creation, 381–399. Mahwah N.J.: Lawrence Erlbaum Associates.

Schreyögg, Georg, Jörg Sydow, and Jochen Koch
2003 ‘Organisatorische Pfade - Von der Pfadabhängigkeit zur Pfadkreation?‘ In G. Schreyögg, & J. Sydow (Eds.), Managementforschung: Vol. 13. Strategische Prozesse und Pfade, 257–294. Wiesbaden: Gabler.

Venkatraman, N. and James E. Short
1990 Strategies for Electronic Integration: From Order-entry to Value-added Partnerships at Baxter: Center for Information Systems Research, Massachusetts Institute of Technology, Sloan School of Management.

Windeler, Arnold
2003 ‘Kreation technologischer Pfade ein strukturationstheoretischer Analyseansatz‘. In G. Schreyögg, & J. Sydow (Eds.), Managementforschung: Vol. 13. Strategische Prozesse und Pfade, 295–328. Wiesbaden: Gabler.

Yin, Robert K.
2003 Case study research: Design and methods (3. ed). Applied social research methods series, 5. Thousand Oaks, Calif.: Sage.