Collaborative implementation of e-business processes within the health-care supply chain: the Monash Pharmacy Project

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Abstract
Purpose – The purpose of this paper is to provide insights into the implementation of e-business processes in the procurement area of a healthcare supply chain when multiple stakeholders are involved.
Design/methodology/approach – A single longitudinal case study spanning three years is presented using data collected from interviews, participant observation, and documentary analysis.
Findings – This study identifies the lack of consistency and poor data quality as well as the global nature of suppliers as key issues in the e-business implementation in the healthcare supply chain. It also points out the need for collaboration and trust for a successful implementation.
Practical implications – This study provides practitioners with a useful guide to the various technology-related, management, and business issues that can arise during the implementation of e-business processes in the context of supply chains involving multiple stakeholders.
Originality/value – This study is distinctive on two grounds: the longitudinal nature of the study over three years; and the wide variety of participants in the Monash Pharmacy Project (including a large general hospital pharmacy, pharmaceutical manufacturers, wholesalers, government regulatory agencies, and technology providers).

Keywords Supply chain management, Electronic commerce, Pharmaceutical products, Health care, Australia

Paper type Research paper

1. Introduction

Information technologies have been deployed in various areas of the health-care sector, including:

- health-care delivery (Fieschi, 2002; Holmes and Miller, 2003; Jennett *et al.*, 1999; Marceau, 2000; Murillo, 2001; Rupert, 2002);
- "tele-health" (Akber and Gough, 2003; Baldwin *et al.*, 2002; Paul *et al.*, 1999);
- medical records (Liu and Ma, 2003); and
- decision-support systems (Lowell and Celler, 1999; Siau *et al.*, 2002).

RFID (radio frequency identification) technology, a relatively new e-business technology in the health-care sector, has also been used in a range of applications such as access to buildings, co-ordinating the supply chain, wireless payment and product authentication (Attaran, 2007). A pilot study undertaken by Janz *et al.* (2005) demonstrates the results of RFID implementation within the trauma unit of the emergency department in a hospital based in Tennessee (USA). This demonstration project has highlighted that RFID implementation is a complex exercise because hardware and software used in RFID needs to be aligned with the associated business practices of the organisation. The study further identified unique data issues such as the problem of misdirected data signals as some readers captured unexpected and unwanted data. Thus, system implementers need to be cognizant of the requirements of the organisation when implementing such a system.

However, the use of e-business technologies to support critical supply-chain functions (such as procurement, distribution and inventory management) has been largely neglected in the health-care sector. This paper focuses on the procurement function within the health- care supply chain. Empirical evidence suggests that the use of e-business processes such as e-procurement can reduce transaction costs by aggregating demand, improving operational efficiencies, enabling an organisation to gain access to a wider supplier base and facilitating the analyses of procurement patterns across different functional departments (Bartezzaghi and Ronchi, 2003; Presutti, 2003). The benefits of adopting e-business processes within health care supply chains have also extensively discussed (see for example Brody, 2007; Smith and Correa, 2005; Zheng *et al.*, 2006). However, little has been reported regarding the actual process of implementation and the issues arising from that implementation when diverse stakeholders are involved, especially not with regard to the procurement function.

The implementation of inter-organisational systems within health-care supply chains is complex because it requires the participation of many different stakeholders, including pharmaceutical manufacturers, distributors, wholesalers, regulatory agencies, and information service providers. The

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complexities embedded in the health-care sector were demonstrated by McKone-Sweet *et al.* (2005), who interviewed 26 stakeholders in a health-care supply chain and demonstrated that the major obstacles to building an effective supply-chain management (SCM) strategy were:

- a lack of support from senior management;
- conflicting priorities;
- limited knowledge of supply-chain management among health-care professionals; and
- relationship bottlenecks between purchasing organisations and other entities in the supply chain.

Other scholars have also pointed out a number of factors contributing to the complexities surrounding pharmaceutical health-care supply chains (Burns, 2005; Karrer-Rueedi, 1997; Kiely, 2004; Scheller and Smeltzer, 2006; Shah, 2004):

- *Clinical factors.* Decisions regarding procurement are made by clinicians who have limited knowledge of supply-chain management. Moreover, the medication requirements of patients are determined by clinical assessments of the prognosis of patients, which are continually changing.
- *Pharmaceutical life-cycle factors.* Pharmaceutical products have long development life cycles and this presents a challenge for supply-chain managers in hospitals, who have to manage their internal relationships with physicians within the hospital while simultaneously managing their external relationships with pharmaceutical manufacturers, wholesalers, and distributors.
- *Institutional and regulatory issues.* The pharmaceutical industry is subject to a wide variety of powerful institutional and regulatory pressures – such as drugs coming off patent, competition from generic drugs, acquisitions and mergers of corporate entities within the industry, compliance requirements from regulatory agencies, and volatile non-technical issues (such as forecasting and demand planning).
- *Extensive product range.* Hospitals generally procure around 15,000 different SKU's (stock keeping units) each year ranging from pharmaceutical products, stationary, gloves and syringes used in patient care to sophisticated machinery (Scheller and Smeltzer, 2006). Problem associated with this extensive product range is further compounded by the fact that there are a wide variety of SKU's within each product category (Kumar and Chandra, 2001).
- *Outdated information systems.* Burns (2002) suggested that the majority of hospitals seem to have outdated information systems with little inter-organisational connectivity as the major IT investment has largely centred on improving health care delivery mechanisms rather than information systems integration that enables the implementation of e-business processes. Additionally, the use of different information systems in different hospital has added to the complexity of the hospitals pharmaceutical information systems.

The present study aims to understand the e-business process implementation in such a complex environment. It seeks to gain an understanding of the complexities involved in successful implementation of e-procurement processes in health-care supply chains. The specific complexities we were interested in spring from the involvement of multiple stakeholders coupled with a high functional uncertainty. This paper thus provides an insight into the experiences and challenges of each stakeholder in the implementation of e-procurement activities in the Australian health-care sector. The longitudinal single case study approach involving a major Australian general hospital was used to achieve this objective.

The remainder of this paper is structured as follows. To provide a context for the present study, the next section provides a brief description of the Australian pharmaceutical health-care supply chain and its initiatives. Section 3 explains the research methodology adopted for this study and its justifications. Section 4 explains the e-business processes implemented within the Monash Pharmacy Project and discusses the results of this implementation. Finally, the conclusion presents the implications of the study and suggests future research directions.

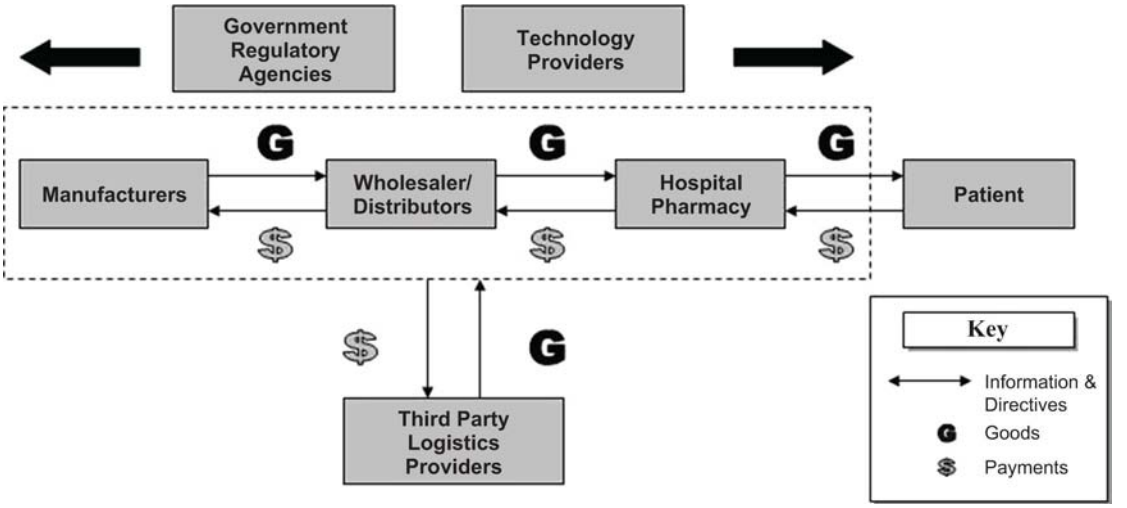
2. Australian pharmaceutical health-care supply chain

The Australian pharmaceutical industry, which is subject to all of these issues, employs approximately 34,000 people and has an annual turnover of AUD$18 billion (Department of Innovation Industry Science and Research, 2008). Figure 1 illustrates the structure of the Australian pharmaceutical health-care supply chain. The scope of the supply chain for the Monash Pharmacy Project, which forms the basis of the present study, commenced with the pharmaceutical manufacturers (designated as "manufacturers" in Figure 1) and terminated when the products reached the pharmacy department of the Monash Medical Centre (designated as "hospital pharmacy" in Figure 1).

The Australian pharmaceutical industry is highly regulated. Figure 1 therefore shows the "government regulatory agencies" – such as the Therapeutic Goods Administration (TGA) and state contracting bodies such as Health Purchasing Victoria (HPV) – which play significant roles in developing policies, standards, and regulations that affect all entities in the supply chain. External entities, such as the "technology providers" shown in Figure 1, also play a significant role in administering bar-coding standards and providing software infrastructure to other entities in the supply chain. The role of the "third-party logistics providers" (at the bottom of Figure 1) is to distribute the products from the manufacturers to the wholesalers/distributors or from the wholesalers/distributors to the hospital pharmacy, depending on the supply chain of the individual organisation.

Evidence from the USA indicates that the health-care supply chain in that country is rather fragmented (Burns, 2002; Scheller and Smeltzer, 2006). The situation in Australia is similar, with an unequal number of organisations within each entity in the supply chain. There are approximately 35 pharmaceutical manufacturers (Medicines Australia, 2008), five wholesalers/distributors (More and McGrath, 2002), and 1250 hospitals (Australian Government: Department of Health and Ageing, 2007) across Australia. To add to this complexity, the headquarters of most of the pharmaceutical manufacturers are located in the United States or Europe, and each of these organisations has a distinct supply-chain structure, with some of them supplying directly to hospitals whereas others use a third-party logistics provider (3PL) and a wholesaler/distributor. Moreover, because Australia has a federal system of government, the state governments are independent entities that have different legislative, funding, and policy structures.

Figure 1 Australian pharmaceutical health-care supply chain



Although the Australian Healthcare and Hospitals Association (AHHA) has adopted a policy that, by 2008, all Australian governments should adopt a nation-wide approach to health policy and service delivery, some states continue to adopt different policies from others, with no "national approach" to the problem in evidence (Rix *et al.*, 2005). A similar situation is apparent within the e-business context in health, with each state pursuing its own strategy regarding the uptake of e-business projects. For example, an independent e-procurement project initiated by the state of New South Wales lacks coherence with e-health projects undertaken by other states (Smartbuy, 2007).

Against this background, Pharmaceutical and Electronic Commerce and Communication (PECC) project for healthcare was an ambitious project that commenced in 1997. This project was a joint activity between government and industry with the objective of introducing e-commerce practices into the health-care sector by automating pharmaceutical and medical consumable supplies to hospitals and retail pharmacies through the adoption of bar-coding standards across all products. This project was successful in setting up the Pharmaceutical Extranet Gateway (PEG), which linked pharmaceutical wholesalers to manufacturers by developing a common Internet-based EDI platform. However, the project faced several significant challenges, including conflicts with stakeholders, funding issues, a culture clash between private-sector and public-sector hospitals, a lack of political support, and communication problems between wholesalers and suppliers (More and McGrath, 2002). Furthermore, the project failed to include hospital pharmacies in its initiative, which is the issue now being addressed by the Monash Pharmacy Project.

Concern about the lack of progress being made with respect to e-business programs in the healthcare sector led to the National e-Health Transition Authority (NEHTA) being initiated in 2005. This entity was established jointly by the federal, state, and territory governments in Australia to develop better ways of collecting and exchanging health information in a secure fashion using e-technology. The formal aim of NEHTA was to support the Australian health system by:

- improving the quality of health-care services;
- streamlining multi-disciplinary care management;
- improving clinical and administrative efficiency; and
- maintaining high standards of patient privacy and information security.

In fulfilling this overall aim, one of NEHTA's objectives was to establish a national supply-chain standard for procurement purposes, part of which was to be a master data alignment via the National Product Catalogue (NPC), which was to provide a single central repository of data regarding standardised and uniquely identified health-care products for use throughout the country (National E-Health Transition Authority, 2007). The NEHTA agenda has thus put significant pressure on the manufacturers and wholesalers/distributors who are responsible for populating the NPC.

It is thus apparent that governments and the entities that constitute the Australian pharmaceutical supply chain have begun serious consideration of the application of e-business technologies to boost efficiency in health care. Although there have been some positive outcomes with these initiatives, little is discussed as to what happened during the implementation of these initiatives, which this study aims to address through a study involving the implementation of a major e-business initiative in the industry.

3. Methodology

3.1 Data collection

A longitudinal, single case-study approach (Yin, 2003) was adopted to facilitate an understanding of the phenomena in their natural environment and to capture detailed qualitative and quantitative data during the implementation. The Monash Pharmacy Project, which forms the basis of the present study, has spanned more than three years (2005-2008). During this time, the following data-collection activities have been undertaken:

- *Direct participant observation.* The entire project involved 40 meetings (22 face to face; 18 via teleconference); the first author was an active participant in these meetings (with his role being disclosed to other participants of the project).
- *Site visits and observations.* Visits and observation were undertaken at the locations where the implementation was undertaken.

- *Document and archive analysis.* Examination and analysis was undertaken of minutes of meetings, status reports, and process flow diagrams.
- *Interviews.* Interviews were conducted with project participants and stakeholders (including hospital pharmacy directors and procurement officers; supply chain and IT managers with manufacturers and wholesalers/distributors; and the project manager); follow-up interviews were also undertaken at the end of the project.

The analysis of the data was conducted inductively rather than with a prior theory in consideration. This means that key themes such as dynamics of relationships, technological issues and management and business issues emerged from the analysis of the data. These broad themes that emerged were subsequently divided into sub categories. The findings report on the themes that were consistently emerged in the data collection activities.

3.2 Background of the Monash Pharmacy Project

The Monash Pharmacy Project was initiated to address a perceived lack of progress in adopting e-business processes in the Australian pharmaceutical supply chain. The champion and key driver of the project was the pharmacy director of Monash Medical Centre, which is a large general public hospital in south-eastern Melbourne with more than 110,000 in-patients a year and a pharmacy department that handles almost 3,000 product lines.

Despite the relatively large scale of its operations, the hospital's pharmacy orders to suppliers were sent via telephone and fax. When the goods arrived at the pharmacy department, the quantity, price, prescription, and expiry dates were entered into a central computer before the goods were issued to other areas within the hospital. These manual processes were labour intensive (especially if errors required correction).

The broad objectives of the Monash Pharmacy Project were to improve efficiency by implementing e-business processes along the pharmaceutical supply chain in particular the procurement areas. In particular, three e-business processes were implemented to achieve the objectives. Figures 2 and 3 provide detailed reference of these processes:

1 *Product identification and bar-coding:*
   - global trade identification numbers (GTINs) bar-coded onto the items; and
   - serial shipping container codes (SSCCs) allocated to logistics units that were being transported between the trading partners.
2 *Electronic messaging:*
   - Electronic data interchanges (EDI) used for purchase orders sent from the hospital pharmaceutical system – Merlin;
   - acknowledgment of receipt of an electronic purchase order acknowledgement;
   - receipt of the appropriate dispatch advice; and
   - scanning of receipt and/or a validation process of items into the pharmacy via the GS1 logistics label placed on the shipment by the supplier.
3 *Data synchronisation:* creation of a file linking the GTINs allocated and marked on the items purchased by Monash Medical Centre pharmacy department to the appropriate supplier internal product codes and descriptions; this enabled unambiguous identification of these items at both the wholesaler and the pharmacy department.

The project was designed in three phases. This research paper reports the first two phases of the project; the third phase, which is build upon the first two phases aims to engage more participants from the healthcare industry. As there are no new initiatives introduced in phase 3, new issues are unlikely to arise and like many other e-business implementation, engaging more participants is a continuing activity after the system/project has been set up. The next section explains the phase 1 and 2 of the project.

4. Findings

4.1 Phase 1: pilot demonstration (2003-2004)

4.1.1 Structure of Phase 1

The profiles of the organisations participating in Phase 1 of the project are listed in Table I.

The initial aim of the pilot phase of the project was to establish a demonstrable supply chain between the hospital pharmacy department and two key wholesalers by introducing e-business concepts based on the Global Standard 1 (GS1) framework. The GS1 components used in this project were bar coding and electronic messaging. Bar coding was used to mark trade items (with GTINs) and shipments (with SSCCs) for moving the goods between members of the supply chain. The electronic messaging standards were based on the EANCOM format. The specific e-messages exchanged were:

- purchase order (PO);
- purchase order acknowledgment (POA); and
- dispatch advice (DA).

The manufacturer (M7) participated in the project by allocating bar codes on all levels of packaging for 20 pharmaceutical items that were regularly ordered by the hospital pharmacy department. These items had not previously carried any form of standard identification.

Figure 2 shows all the processes that were executed in this phase of the project. For the wholesaler, the process included:

- receipt of a purchase order via EDI from the hospital pharmaceutical system;
- sending a purchase order acknowledgment to confirm its ability to fulfil the order; and
- sending dispatch advice of the items as they were packed into cartons with appropriate identifier and bar code placed on each physical shipment (logistics unit).

For the pharmacy department, the process included:

- sending the purchase order via EDI from the hospital pharmaceutical system;
- receipt of a purchase order acknowledgment; and
- receipt of the dispatch advice and scan receipt and/or a validation process of items into the pharmacy logistics label placed on the shipment by the supplier.

The project also included a comparison of a "pick-and-pack" scenario with a semi-integrated scenario whereby goods were not scanned during the pick process, but were scanned "confirmed" as they were packed for transport with a manual "confirmation-and-pick" process. In addition, during the course of the project, wholesaler B scanned packed goods (following picking) as an "add on" to their existing process.

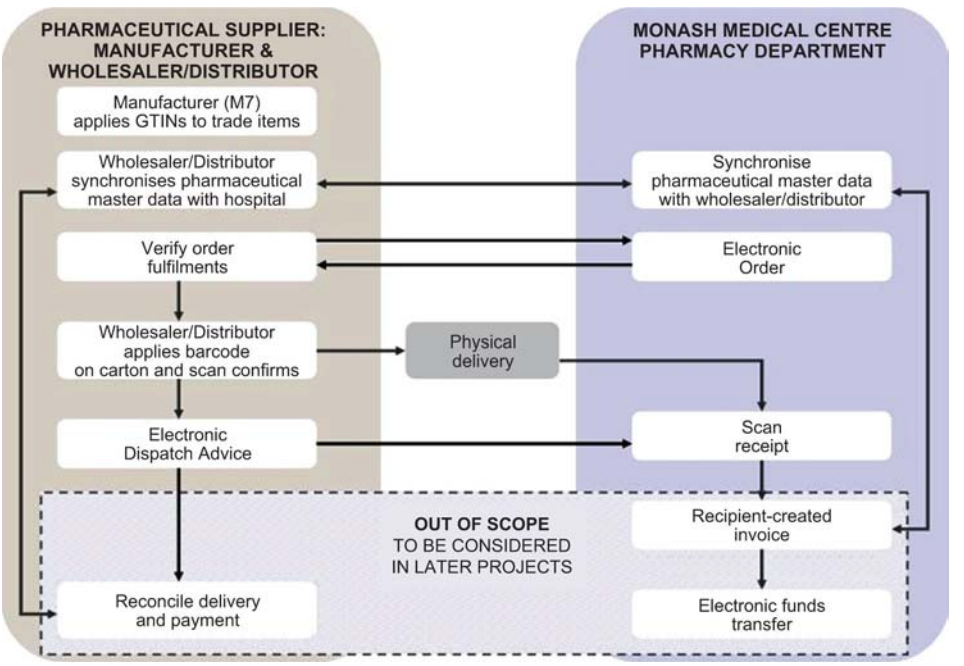
4.1.2 Results of Phase 1

Phase 1 of the project provided evidence of a workable and clear demonstration of e-business processes based on the GS1 framework along the pharmaceutical-procurement supply

Table I Monash Pharmacy Project Phase 1: Participants and their roles

Organization type	Head quarters	Products	Annual turnover (world-wide)	No of stock keeping units	Project involved or role in the project
Manufacturer (M7)	Australia	Pharmaceuticals antiseptics and disinfectants	Not available	150	Bar-coding
Wholesaler A (WA)	Australia	Equipment medical and pharmacy products	A$1.3 billion	15,000	Electronic messaging
Wholesaler B (WB)	Australia	Pharmacy and non-pharmacy products	A$3.4 billion	17,000	Electronic messaging
Monash Medical Centre	Australia	Pharmacy products	A$38 million (Pharmacy department)	3,000	Electronic messaging key driver and project sponsor (role)
Government Regulator	Australia	Pharmacy and non-pharmacy products	A$500 million worth of contracts	N/A	Project chair (role)
Technology Service Provider A	Belgium	N/A	Not available	N/A	Project management expertise (role)
Technology Service Provider B	Australia	N/A	Not available	N/A	Software vendor for public hospital (role)

Figure 2 Scope of Phase 1 of the Monash Pharmacy Project



chain. Furthermore, it enabled the establishment of a cohesive team that included a diverse range of stakeholders and developed a business case with a scope for expansion in future projects.

The hospital pharmacy department was the recipient of most benefits in this phase. In particular, the time taken to receive the goods was decreased by approximately 20 percent (from 51 minutes to 40 minutes). This can be attributed to the removal of the need for purchasing staff to undertake a manual check of the stock received against the invoices. Moreover, there was a significant improvement in the accuracy of deliveries received by the pharmacy department from the wholesalers. Incorrect deliveries decreased from 8 to 3.75 per order, which can be attributed to use of appropriate GTIN and SSCC labels on the goods entering the pharmacy department. However, it should be noted that it was necessary to introduce four new steps in the order-placement stage as a result of the new processes.

The results for the wholesalers varied in accordance with each organisation's strategy for participation in the project. Wholesaler A did not scan items as they were being packed into cartons; however, this wholesaler did begin to send the dispatch advice electronically. This resulted in four new process steps being required, which added marginally to the time taken to send the dispatch advice; on the other hand, it did result in a significant improvement in the accuracy of

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deliveries (with the number of claims/queries regarding orders being decreased from 6 to 1).

For Wholesaler B, the result of the implementation did not present a compelling argument for the adoption of e-business processes. Although Wholesaler B "scan packed" the goods for delivery, this process was an "add on" to the existing processes in its warehousing operations, which resulted in a substantial increase in packing time (from 1 hour 51 minutes to 2 hours 58 minutes). Furthermore, the time taken to label each carton increased from 30 seconds to 1 minute 20 seconds, and an additional staff member was required to pick, pack, and label stock. Given the cost and time constraints of Phase 1 of the project, the strategy adopted by Wholesaler B seemed to be the only viable option; however, in future, Wholesaler B might be forced to consider a complete strategic change in its operations to secure greater efficiencies (Power and Simon, 2004).

4.2 Phase 2: Actual implementation (2005-2008)

4.2.1 Structure of Phase 2

The objectives of Phase 2 were to:

- replicate the methodology of Phase 1 (electronic messaging) with additional trading partners;
- identify bar coding on trading items; and
- implement data synchronisation via the NPC.

The participants within Phase 2 of the project are listed in Table II. Please note that M7, the manufacturer that participated in Phase 1, was not able to be involved in this phase because of an internal restructure in their organisation.

Phase 2 of the implementation was divided into three sub-projects:

1. identification and bar coding of trade items on various levels of product packaging;
2. rolling out electronic messaging for procurement purposes to other hospitals, wholesalers, and manufacturers; and
3. data synchronisation by loading data onto the NPC and then having it passed to a relevant trading partner.

Before the commencement of Phase 2, organisational "e-Readiness surveys" were conducted within each organisation. The purpose of these surveys was to assess the level of e-business adoption for each of the participating organisations and to determine whether these organisations had sufficient financial resources to fund themselves through Stage 2. The survey results highlighted that each organisation was at a different stage in their uptake of e-business technologies. This finding facilitated in providing the necessary flexibility to each organisation in determining the scope of their participation in the various sub-projects that best aligned with their internal goals and objectives. It also ensured the support of senior management and securing financial commitment for the project.

Figure 3 shows how each organisation was engaged in Phase 2 of the project. With regard to the first sub-project, Manufacturer 3 chose to apply bar codes with the batch number and expiry date at the shipper (carton) level of the products. The objective of this exercise was to enable internal tracking of the item, batch, and expiry date within the warehouse and to extend this to trading partners that received carton-level stock.

In the second sub-project, which involved electronic messaging, Manufacturers 2, 4, and 6 interacted directly with the hospital pharmacy department by repeating the messaging standards used in Phase 1. In contrast, because Manufacturers 1 and 5 had a different supply-chain structure and supplied goods only through the wholesaler, their electronic messages were relayed onto the wholesaler who, in turn, communicated with the hospital pharmacy department.

Although several manufacturers participated in the third sub-project (data synchronisation), significant progress was reported only from Manufacturer 2, which synchronised its data with the pharmacy department at the Monash Medical Centre.

4.2.2 Results of Phase 2

As noted above, Phase 2 of the project was sub-divided into three sub-projects. The results for the bar-coding sub-project replicated the benefits achieved in Phase 1. Through the two phases of this project, the initiator, Monash Pharmacy established that stock with more than 93 percent of unit level products allocated with global identification (i.e. GTIN). Detailed KPIs were not captured for the electronic messaging sub-project because the objective was merely a broader roll out of electronic messaging among the other trading partners.

The data-synchronisation sub-project identified several important issues with respect to data quality. For example, Manufacturer 2 (M2) was able to populate the NPC with all of its product lines; however, a comparison with the hospital pharmacy database revealed that details of only 25 percent of the total product lines were on record. This indicated that the hospital pharmacy department recorded only those items that it had previously purchased. Moreover, it was found that:

- there was a mismatch in the descriptions of trade items between the records maintained by the pharmacy department and those maintained by M2;
- 92 per cent of the brand names were inaccurately represented; and
- selling price inconsistencies were reported for 28 per cent of the records.

Several factors could account for these discrepancies. These include:

- confusion over the level of packaging;
- each entity using its own convention for record keeping; and
- the hospital failed to update its database when changes occurred in the price or the brand name for a specific drug.

5. Discussion

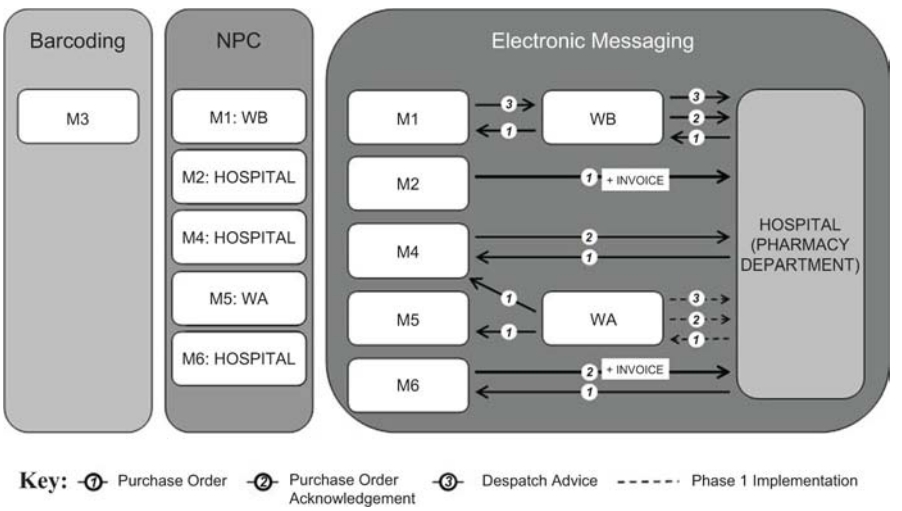
5.1 Dynamics of relationships

Because the implementation of e-business processes through the Monash Pharmacy Project was initiated by the Pharmacy Department of the Monash Medical Centre to facilitate its relationship with its suppliers, the project could be viewed, from the hospital's perspective, as a supplier-centric initiative (Chan and Swatman, 2004). On the other hand, because the Monash Pharmacy Department is one of the largest pharmaceutical buyers in the country, the suppliers viewed the implementation as a customer-centric initiative (Chan and Swatman, 2004) through which they demonstrated their commitment to their customers and achieved their strategic objectives of improving communication, forming closer relationships, and locking in their customer.

Table II Monash Pharmacy Project Phase 2 participants and their roles

Organization type	Head quarters	Products	Annual turnover (world-wide)	No. of stock keeping units	Project involved or role in the project
Manufacturer (M1)	Australia	Oncology	A$687 million	1,200	Electronic messaging data synchronisation
Manufacturer (M2)	US	Intravenous solutions IV fluids	US$9.8 billion	9,000	Electronic messaging data synchronisation
Manufacturer (M3)	US	Cardio-vascular neuroscience oncology	US$20.9 billion	500	Bar coding
Manufacturer (M4)	US	Nutritional pharmaceutical medical	US$25.9 billion	300	Electronic messaging data synchronisation
Manufacturer (M5)	Switzerland	Vaccines and diagnostics generic treatment drugs	US$26 billion	N/A	Electronic messaging data synchronisation
Manufacturer (M6)	US	Pharmaceutical products animal health products	US$48.4 billion	N/A	Electronic messaging
Wholesaler A (WA)	Australia	Equipment medical and pharmacy products	A$1.3 billion	15,000	Electronic messaging data synchronisation
Wholesaler B (WB)	Australia	Pharmacy and non-pharmacy products	A$3.4 million	17,000	Electronic messaging data synchronisation
Monash Medical Centre (Pharmacy Department)	Australia	Pharmacy products	A$38 million	3,000	Electronic messaging data synchronisation
Government Regulator A	Australia	Pharmacy and non-pharmacy products	A$500 million worth of contracts	N/A	Group chair (role)
Technology Service Provider A	Belgium	N/A	N/A	N/A	Project management expertise (role)
Technology Service Provider B	Australia	N/A	N/A	N/A	Software vendor for public hospital (role)

Figure 3 Scope of e-business implementation in Phase 2



The dynamics of the relationships within this project can also be explained by "stakeholder theory" (Freeman, 1984).This theory is grounded in the business ethics literature (Barringer and Harrison, 2000; Phillips *et al.*, 2003) and states that an organisation's stakeholders are a cohort of individuals who can influence or are influenced by the organisation such as investors, suppliers, customers, trading partners, employees, government, local and professional communities, competitors, financial community and so on (Donaldson and Preston, 1995; Freeman, 1984). In the first phase of the implementation studied here, the initiator (Monash Pharmacy) gained most of the benefits whereas its trading partners received very few (if any) benefits. For example, in the first phase of the project, the suppliers were forced to duplicate certain steps (such as labelling) and add new steps (such as sending dispatch advice) to accommodate the new business processes required. However, this did not discourage the suppliers from participating in (and supporting) the second phase of the implementation. This could be said to reflect the dominant power of the end customer (Monash Pharmacy); however, it

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also indicates the strategic intent of the hospital's trading partners, who were interested in gaining more than short-term financial benefits. Such phenomenon is not new. Trading partners (that is, customers) play a significant role in influencing the process of implementation. In fact, earlier studies on EDI implementation believe that most EDI implementations were driven by customers' demands on suppliers to implement the system. Iacavou *et al.* (1995), for example, studied EDI in small organisations and found that partner imposition is one of the most critical adoption factors in small organisations.

5.2 Technology-related issues

Several technology-related problems were identified in the first phase of the implementation. Many of these problems were common "teething" problems of a type that can be expected in learning any new process, as have been identified in previous studies (Chan and Swatman, 1999, 2003).

In Phase 2, poor data quality was identified as one of the most important issues. Although concerns about the quality of data have been raised internally in hospitals (Williams *et al.*, 2006), this issue has not been discussed in the context of a health-sector supply chain. In the project studied here, poor data quality caused a number of problems. These included:

- incorrect stock being supplied to the pharmacy when a product number GTIN referred to a different product from the one that was ordered; and
- some stocks not having the correct product number, which forced suppliers to abandon the e-business procurement arrangements and personally advising the hospital of the inclusion of these particular items.

It was recognised that ongoing data synchronisation was required to prevent these problems. The poor quality of some data had spill-over effects on product availability, product identification/authentication, and accuracy in prescribing/administrating drugs. The importance of data quality to data synchronisation has been emphasised in previous studies (Gopal and McMilliam, 2005), but the potential for serious consequences in a health-care supply chain (that is, placing patients at risk) have not been fully investigated. Nevertheless, the need for an industry-wide data standard in the health-care industry has been noted by Brody (2007), who claimed that 24 per cent of administration time in health-care procurement is spent on data cleansing.

Incorrect practice in data scanning was another significant issue in the present implementation. Items were often short supplied due to incorrect scanning when staff members manually counted scanned items until they equalled the number of required items (rather than scanning every item as required). Although such practices are not new in many industries (such as retail), this practice was not common in health care. Suppliers therefore need to ensure that the correct processes are diffused throughout their organisations through education and on-going training, a tactic used for people-determined implementation. In addition, a greater proportion of errors were identified in the scanning process after the introduction of the new system; however, further investigation revealed that these extra errors occurred because workers had become less conscientious as they knew that their work was being double-checked by the system. Finally, because hospital information systems contain a large amount of confidential data, health-care providers are wary of installing third-party communications software on their business servers. This led to discrepancies between the information transmitted by the suppliers and that received by the hospital pharmacy department.

5.3 Management and business issues

Empirical studies have demonstrated that management and business related factors influence the implementation process to a greater extent than do technology-related factors (Chan and Swatman, 2002; Doukidis and Fragopoulou, 1994; Emmelhainz, 1992; McGowan and Madey, 1998). Management and business issues that have been identified have included a lack of management support, user resistance, and inadequate e-business resources. The present study identified some additional issues that are specific to the character of the health-care industry.

First, mergers and acquisitions of organisations in the health-care sector are quite common, and this can affect software capabilities. In the present project, one of the suppliers (M1) and one of the wholesalers (WA) were involved in mergers and acquisitions. This affected the progress of the project as these organisations were forced to deal with their internal problems (such as software migration and doubts about support of the project under the new leadership).

Second, because the Australian pharmaceutical market represents only 1 per cent of the world market (Department of Innovation Industry Science and Research, 2008), it was difficult for the pharmaceutical manufacturers to become involved in these initiatives unless they were driven by their global head offices. Moreover, the senior managers of some firms were reluctant to participate in e-business projects because a return on investment is not guaranteed in such initiatives.

Third, trust building was a significant aspect of this project. This was in accordance with the literature, which has emphasised the importance of trust in many inter-organisational e-business initiatives (Gallivan and Depledge, 2003; Grossman, 2004). At the outset of the present project, participants were asked to sign confidentiality agreements to ensure that frank and open discussions would ensue. This encouraged participants to share their learning experiences, which was identified as one of the most important processes in the project. The importance of trust building in the health-care industry has been emphasised in a study of US hospitals (Hausman and Stock, 2003), which concluded that a high level of trust between suppliers and focal firms accelerated adoption of technological innovations by the suppliers.

6. Conclusions and implications for future research

The Monash Pharmacy Project is an excellent example of industry collaboration driving the application of e-business processes within the health-care sector. The project initially began as a demonstration project and grew to include more than a dozen organisations within the pharmaceutical health-care supply chain in Australia. This further confirms the success of a collaboration approach employed in this e-business process implementation.

The project identified several issues dealing with product identification, including: a lack of consistent global identification standards throughout the health-care supply chain; and the poor quality of data maintained by project participants. The identification of these issues should be of benefit to future e-business initiatives in health-care supply

chains. Although Australia accounts for only a very part of the world pharmaceutical market, this project has motivated some of the global suppliers' head offices to consider further initiatives to enhance product traceability. It is worth noted however, involvement in a project like this can be costly in terms of both time and money – for example, one of the suppliers had to apply for both an internal label and a global GS1 standard label (as requested by the Monash pharmacy project) to ensure that the correct item was being collected, which entailed significant additional processing time and costs for the organisation. Additionally, this study showed that the global nature of the healthcare supply chain might influence the success or otherwise of e-business process implementation. This again emphasises the need for trust and collaboration toward completing the project successfully.

In methodological terms, this study has two significant strengths. First, conducting a longitudinal case study (consisting of two phases) over three-year period has enabled the researchers to gain valuable insights into the long-term implementation of e-business techniques in a health-care supply chain; this would not have been possible with a simple cross-sectional case study at one point in time. Second, the variety of participants involved in this project (including the hospital pharmacy department, manufacturers, wholesalers/distributors, government agencies, and technology providers) has illuminated a variety of issues that might not have been apparent in a more circumscribed study with a smaller number of participant organisations. Although this project was confined to Australia, most of the key lessons learnt from this project can be applied to other international projects within the health-care industry.

In the future, the inter-relationships among the participating organisations and the motivation of each organisation for being involved, beyond those identified as "major customer imposition" should be further investigated, Such study could further assist in our understanding of the dynamic relationships (such as power, communication structure and trust building) between trading partners involved in the implementation of inter-organisational processes such as e-business leading to a more effective and successful management of the implementation process.

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