

Factors contributing to the success of customer oriented interorganizational systems

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Interorganizational systems (IOS) can help firms to become more efficient and more competitive by streamlining operations between companies. To build successful IOS, the development process needs to be well understood. This paper uses a four-stage model of the IOS development process to examine the experiences of nine systems that link firms with customers. The data provides considerable support for the model and its numerous factors. Technological awareness by customers was found to have a strong influence on the rate of adoption. Extent of adoption is the major determinant of ultimate success of the IOS.

Keywords: interorganizational systems, strategic information systems

During the 1980s, use of interorganizational systems has become increasingly widespread. Interorganizational systems (IOS) attract attention because they are highly visible systems which often create a significant impact on participating organizations. Systems like American Hospital Supplies' ASAP, McKesson's Economost and American Airlines' Sabre are well-known examples of IOS.

These systems capture the interest of information systems (IS) practitioners and academics. Although there have been a number of successful IOS, it is not yet clearly understood how and why some IOS become successful while others fail. Research has begun to try to find underlying factors that may contribute to the relative success of inter- systems (eg Benjamin *et al*, 1990; Johnston and Vitale, 1988; Reich and Benbasat, 1990). This paper extends previous work by bringing together the many potential success factors that have been identified and then examining them through the use of nine case studies. In addition, the paper explores whether success factors are all equally relevant and suggests that some may be more important than others; this issue has not previously been addressed.

The paper first outlines existing research findings concerning factors which contribute to the successful completion of various stages of the IOS development

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process. The major part of the paper consists of case evidence derived from investigation of nine systems linking organizations with their customers. The case evidence is used to discuss success factors impacting on the building of customer oriented IOS (CO-IOS), on the implementation and adoption of CO-IOS, and on the ability of firms to reap benefits from the CO-IOS.

Previous research

The concept of IOS has been around since the 1960s (Kaufman, 1966), and gained considerable interest in the 1980s. Several successful IOS have been documented and can be shown to have provided clear strategic benefits to the sponsoring organization (eg Clemons and Row, 1988; Copeland and McKenney, 1988). Systems which cross boundaries impact on the sponsoring organizations and also on the other participants, providing benefits to each of the parties involved and, by nature, linking the organizations closer together (Johnston and Vitale, 1988). Interorganizational systems are thus also strategic information systems and, conversely, many strategic information systems are also interorganizational systems (Johnston and Vitale, 1988; Suomi, 1992).

There are many different types of IOS, and each can be classified in a number of ways. IOS can be categorized according to the relationship between the sponsoring organization and the participants (Johnston and Vitale, 1988). Possible participants can include suppliers, distributors, customers as well as suppliers' suppliers and customers' customers. IOS can also be classified according to participation level (Barrett and Konsynski, 1982). Their five levels of participation indicate increasing degrees of participant responsibility, cost commitment and complexity of operating environment. A third way that IOS can be categorized is by information function of the system (Johnston and Vitale, 1988). Systems may be designed to handle boundary transactions between organizations; systems may enable independent information retrieval and analysis; systems may be designed to manipulate information as part of 'back office' operations in participants' organizations.

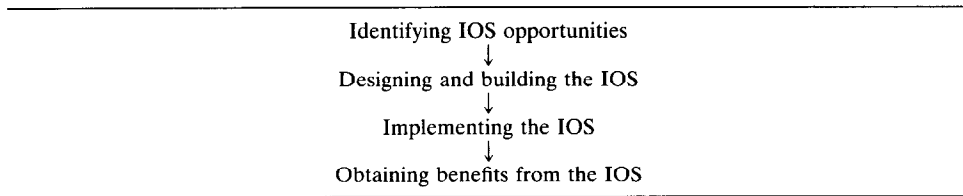
Research into IOS goes beyond mere description and classification. Authors are also interested in factors which may contribute to the success of such systems and much of this work draws on strategic information systems research. A number of studies have identified success factors for strategic information systems (SIS), and these are reviewed by Cavaye and Cragg (1993). The review built on Reich and Benbasat's (1990) model of the SIS development process, and identified success factors for various stages of the process. This model can be applied to interorganizational systems and is therefore adopted as a framework for this paper. The model and the various success factors are discussed briefly in the following sections.

An IOS development model

Reich and Benbasat (1990) broke down the process of developing an IOS into a number of stages. They recognized that each individual stage may be completed, but this did not guarantee that the organization was able to successfully complete the subsequent stage. A four-stage model, adapted by Cavaye and Cragg (1993) from Reich and Benbasat (1990), is given in *Table 1*. Each stage is discussed briefly below, along with related research on the many factors that influence success.

Identifying IOS opportunities. No system can be developed without the original idea for its development having germinated. The success measure of this early

Table 1 IOS development model



development stage is that an opportunity must be identified and evaluated.

Opportunities can be actively sought, or may spontaneously present themselves to an organization (Ciborra, 1991; Galliers, 1991). Factors impacting at this stage are: use of frameworks to help find opportunities (Ives and Learmonth, 1984; Porter and Millar, 1985; Ives and Vitale, 1988), a need to enhance internal operations (Neo, 1988); a need to respond to competitive pressure (King and Sabherwal, 1992; Reich and Benbasat, 1990); and technological advances may present a new opportunity (Johnston and Carrico, 1988; Neo, 1988).

Designing and building the IOS. Once opportunities are identified, firms have to design and build the system before being able to exploit opportunities. The completion of the building of an IOS indicates the outcome of this stage of development.

A number of conditions facilitate this development stage: an enthusiastic champion/application sponsor (Runge, 1985); top management support to commit time, people and financial resources to the project (Neo, 1988; Reich and Benbasat, 1990); many IOS evolve by extending existing systems beyond company boundaries (Cash and Konsynski, 1985); experienced IS staff enable an organizations to design and build an IOS, often using the experience gained in one system to build another (Reich and Benbasat, 1990).

Implementing the IOS. Once a system has been built it has to be accepted by and adopted by its intended users. A sponsoring organization may insist on potential IOS users adopting the system — the use of EDI in the automobile industry is a good example of 'forced' adoption of IOS. When adoption of the IOS is voluntary, success of the implementation stage may be measured by adoption rate (Reich and Benbasat, 1990; Runge, 1985).

There are factors which impact on and determine the relative success of the implementation stage: systems built in reaction to needs expressed by customers were adopted more quickly than systems built in the absence of an expressed need (Reich and Benbasat, 1990); users' views and needs can be learnt and accommodated by involving users in the design process (Runge, 1985); empirical evidence suggests that passing on a high cost of the system to the user leads to slow adoption, while a low or nominal cost is associated with fast adoption (Reich and Benbasat, 1990); superior marketing programmes have an enabling effect on system adoption (Reich and Benbasat, 1990; Runge, 1985).

Obtaining benefits from the IOS. If the system has been implemented and adopted successfully a firm is able to reap its benefits. The potential benefits to a firm are related to the impact dimension of system success (DeLone and McLean, 1992), and include increased market share, greater cost effectiveness, higher sales volumes and enhanced customer loyalty (eg Porter and Millar, 1985; Johnston and

Table 2 IOS development model including success factors and outcome measures

Development stage	Factors impacting on each stage	Success measure of each stage
Identification of IOS opportunity	<ul style="list-style-type: none"> • Use of frameworks • Internal need • Competitive pressure • Technological opportunity 	Opportunity for a system identified
Designing and building of IOS	<ul style="list-style-type: none"> • Application sponsor • Top management support • Build on existing system • IS staff experience 	IOS building completed
Implementing IOS	<ul style="list-style-type: none"> • Expressed user need • User participation in development • Cost of system to user • Marketing of system 	IOS adoption rate in first year after launch
Obtaining benefits from IOS	<ul style="list-style-type: none"> • System penetration • Competitor reaction 	<p>Tangibles:</p> <ul style="list-style-type: none"> — increased sales — increased market share — lower operational costs <p>Intangibles:</p> <ul style="list-style-type: none"> — increased user satisfaction — enhanced image in industry

Vitale, 1988; Reich and Benbasat, 1990). All of these affect the competitive position of the firm.

The penetration of the system into the market (Reich and Benbasat, 1990), and the reaction of competitors (Clemons and Row, 1987) are the only factors discussed in the literature to impact on a firm's ability to reap these benefits. If competitors react by implementing a similar system, the competitive edge gained by the first organization may only be temporary. Often the use of IT becomes a strategic necessity within the industry.

An expanded IOS development model

Table 2 summarizes the above discussions on prior research, and presents an expanded IOS development model, including the success factors and success outcome measures.

Research objectives and method

Although many potential success factors have been identified, there is little rigorous, empirical evidence concerning the factors that facilitate or inhibit the success of inter- systems. This research study was designed to provide further empirical evidence about such factors. In particular, it aimed to examine the full range of variables that had been identified in prior studies and to test the completeness of the model. A secondary objective concerned the relative importance of various factors. From previous research it is not clear whether all success factors need to be present at any one time in order to facilitate IOS development. This study intended to explore this issue. The model depicted in Table 2 was adopted as the study's research model.

As the research topic is relatively new and in-depth data was required for a broad range of variables, a case research approach was taken. Nine organizations were selected for this study. The criteria for selection were similar to those used by Runge (1985) and Reich and Benbasat (1990). Thus the firms had to be profit-oriented, and had to sell a product or service. The systems had to be fully implemented systems designed to link the organizations with their customers. System facilities had to enable the firm to enhance the core business. Furthermore, adoption and use of the system by customers had to be voluntary.

The specific case methodology followed was the structured methodology advocated by Yin (1989). The study commenced with a research model, collected data from several organizations, analysed the data for each individual case and then brought findings together in cross case analysis. An interview guide was prepared by adapting the instruments used by Runge (1985) and Reich and Benbasat (1990). The interview guide was pilot tested and modified before being used for the full study.

Lengthy personal interviews were carried out with at least two members of each organization. Typically this involved the member of top management most closely involved with the system (the sponsor), and at least one person from IS (usually both the person in charge of IS and the person in charge of the development project). Additional information was obtained by contacting customers who use the systems. Documentation was also collected, in the form of annual reports, promotional literature, and newspaper clippings. The interviews were recorded and transcribed. The interview data and documentary data were subsequently analysed using techniques described by Miles and Huberman (1984).

The nine cases involve New Zealand organizations using IS to link with their customers. The systems are all CO-IOs and include electronic order entry systems, cash management systems and freight tracking systems. Several of the organizations requested anonymity and for that reason none of the cases are identified in this paper. Limited data is provided in *Table 3*; detailed information on the cases is provided in Cavaye (1993).

The cases are taken from several industries in order to avoid industry bias. Many industries in New Zealand do not have more than one or two examples of these kinds of systems. In order to obtain a balanced case sample, not more than two systems from any one industry were selected. Cases include first-mover as well as follower systems. However, it is not always easy to designate a case as a 'follower' since each sponsoring organization attempts to provide a novel system which is superior to a previous one in the industry.

Case findings

Data was collected on success factors and success outcomes for each development stage. The case data was then used to examine each part of the research model. Each stage and each factor is examined in turn, using the data from all nine cases. Tables, summarizing the case evidence relating to each factor, are presented at the end of each section.

Identifying CO-IOs opportunities

No system can be developed without the development opportunity having been identified. The research model contained four variables as likely to influence this identification process.

Table 3 Description of the individual cases

Case	Industry	Description
1	Banking	Cash management system enabling customer to access accounts and carry out bank transactions. A generic cash management system was developed by a bank service provider in the 1980s. The bank adopted the system and modified it for launch to its customers in 1989.
2	Banking	Real-time, on-line cash management system in Windows environment. This system was first offered in 1992. In contrast to earlier cash management systems, this system can run on various platforms and as such as a highly versatile product.
3	Clothing manufacturing	System enabling electronic receipt of purchase orders from and sending of invoices to customers. This is a mainframe-to-mainframe EDI application, first introduced in 1991, linking clothing manufacturer to major customers.
4	Credit reporting	PC-based access from customers' premises to mainframe allowing customers to carry out independent credit reporting searches. The credit reporting organization designed the system on their own and offered it to customers in 1988. Customers can obtain credit reports on individuals and on companies.
5	Office products wholesaling	Terminal or PC-based access to mainframe to place orders, check on prices and availability, check account information. Offering this facility to customers in 1987 was relatively easy because the system is a simple extension of an internal system that was already operational at the wholesalers.
6	Pharmaceutical wholesaling	Handheld units used by pharmacies to order drugs and over-the-counter products from the wholesaler. Portable data entry units were introduced to pharmacists in 1977 as an extension to the computerized internal order processing system of the wholesaler. Though slow to take off initially, electronic order entry now accounts for 87% of all trade with the company.
7	Pharmaceutical wholesaling	PC-based system for pharmacies with stock control and electronic ordering facilities. This system, first offered to customers in 1991, provides not only a link with the wholesaler, but also offers a wide array of back-office functions to the pharmacist.
8	Transport	PC-based system which enables preparation and uploading of consignment notes and allows freight tracking by customers. The system was developed after the financial controller of the company visited US freight companies and saw similar systems. It has been available to customers since 1991.
9	Transport	EDI application enabling transmission of freight documentation, customs clearance and freight tracking. This system is aimed at customers with international freight requirements, speeding up documentation processing at ports.

Use of frameworks. No formal planning or searching for competitive IS applications took place in any of the firms. The IOS did not result from the use of official frameworks to help identify opportunities.

Internal need. In none of the firms was there a pressing need to improve internal

operations; there was no evidence of a real, internally identified need for IOS development.

Competitive pressure. In two of the cases there was clear competitive pressure for the organizations to develop their application: one of the banks and one pharmaceutical wholesaler realized that they had to follow leaders in the industry and offer similar facilities. A bank nowadays must be able to offer cash management facilities in order to be a serious contender when tendering for corporate accounts. Similarly, for pharmaceutical wholesalers in New Zealand, it is now a strategic necessity to offer one-stop-shop facilities to pharmacists, to be suppliers of prescription drugs and over-the-counter products, and provide computer system support.

Technological opportunity. Eight of the organizations developed their IOS in response to becoming aware of the technology and of the opportunities thus presented.

In three of the cases network providers had introduced the organizations to the technology. In four cases, members of the top management team had visited the USA and had seen technology being used in novel ways in their respective industries. In each of these cases the managers, on coming back to New Zealand, initiated development of similar systems in their own organizations: the technology was available, the opportunity was recognized and the IOS was identified.

The eighth case involved a bank which had only recently developed a cash management system, several years after the first cash management systems appeared in New Zealand. The bank was a clear 'follower' in this respect, but used advances in technology to offer the first Windows-based cash management system in New Zealand. Hence, this case too concerns an organization taking advantage of opportunities provided by technology.

Table 4 summarizes the extent to which the various success factors of this development stage did indeed contribute to the identification of the CO-IOS opportunity. Table 4 shows ratings for each factor, and indicates the outcome of this early development stage in terms of an opportunity having been successfully identified.

Two of the four factors, use of frameworks and internal need for a system, did not play a role in the identification of the IOS for any of the organizations. Competitive pressure was important in two of the cases. The major factor

Table 4 Factors contributing to system identification

		1	2	3	4	5	6	7	8	9
Identification factors	Use of frameworks	—	—	—	—	—	—	—	—	—
	Internal need	—	—	—	—	—	—	—	—	—
	Competitive pressure	—	yes	—	—	—	—	yes	—	—
	Technological opportunity	yes	yes	yes	yes	yes	yes	—	yes	yes
Identification of outcome measure	Opportunity for a system identified	yes	yes	yes	yes	yes	yes	yes	yes	yes

motivating organizations towards development of their new systems was technological opportunity.

This case evidence suggests that the identification of an IOS opportunity comes either in response to competitive pressure or as a result of recognizing a technological opportunity. Each organization identified and evaluated an IOS opportunity and then decided to go ahead with designing and building the system.

Designing and building the CO-IOS system

According to existing research findings, four factors facilitate the designing and building of an IOS. Each of these factors is briefly discussed here and comparative case data is presented in the summary table at the end of the section.

Application sponsor. In five of the cases, the building of the IOS was driven by an enthusiastic application sponsor/champion. In one case (Case 3) development of the system was to some extent driven by customers who asked for the system; there was no clear application sponsor within the organization.

Top management support. Three of the cases enjoyed top management support for the project, with top management taking a personal interest and becoming personally involved in the IOS development project. In the six other cases, the IOS development project received the necessary resources but top management did not get closely involved in development.

Varying levels of top management commitment and participation may reflect different company culture and as such does not necessarily indicate particular support for the IOS project. It is therefore more meaningful to indicate how the level of management support for the IOS project compared to the support extended to other IS projects in the sponsoring organizations. In each case, the extent of support given to the project was the same as that usually given to IS projects within the organizations.

Build on existing system. Most of the organizations had well-established, computerized, internal systems before extending the system beyond company boundaries. One of the organizations (Case 9) took the opportunity of building the IOS to redesign and upgrade existing systems whilst developing the IOS. Case 4, the credit reporting company, had to convert a completely manual system to a large, mainframe-based database application in order to enable computerized access by customers; their IOS application was not an extension of existing systems, but was all new.

IS staff experience. The various organizations used a number of different methods to complete the design and build stage of development. Some organizations used their own IS capability and experienced staff. Other organizations had no IS department, no development staff, and no programmers or, alternatively, chose not to develop the IOS in-house. These organizations outsourced software development so that their system was built by experienced professionals. Altogether, the IS personnel entrusted with the building of the IOS system had, on the whole, experience of such systems.

One organization (Case 4, the credit reporting company) had access to well-trained IS staff, but none of the development team had experience of building large database applications. This company now feel that their application solution might have been more elegantly put together, but is still very satisfied with the

Table 5 Factors contributing to successful design and building of system

		1	2	3	4	5	6	7	8	9
Design and build factors	High-level, enthusiastic application sponsor	—	—	—	yes	yes	yes	—	yes	yes
	Top management support	average	average	average	average	average	average	average	average	average
	Build on existing system	yes	yes	yes	—	yes	yes	yes	yes	—
	IS staff experience	—	yes	yes	—	yes	yes	yes	yes	yes
Design and build outcome measure	Building of system completed	yes	yes	yes	yes	yes	yes	yes	yes	yes

product they were able to build.

Another organization (Case 1, a bank) put in charge of the IOS project a manager who knew nothing about systems and who was himself computer-illiterate; at the same time, members of the project team were continually changed. The bank now agree that they did not make use of appropriate personnel and that this may have contributed to the length of time taken to develop their cash management system.

Table 5 summarizes the factors previously identified as contributing to successful design and building of the systems.

All organizations in the case sample successfully built the capability for an IOS. According to this case evidence, involvement of a high-level sponsor and strong top management support are not necessarily required to enable the building of electronic order entry facilities. As long as top management provide the resources required it should be possible to build an IOS. An internal system existing prior to extending the system to customers, and using development staff with experience in such systems, limits the risks involved in building electronic order entry facilities. Again, though, it does not appear to be essential that an IOS builds on existing order entry systems or uses experienced staff during building of the system. The experience of Case 4 would suggest that enthusiasm and hard work can make up for the absence of a system to build on and for lack of experience.

At the end of the designing and building stage of the development process, all organizations had an IOS that technically worked and that was ready to be offered for customer use.

Implementing the CO-IOs

An organization cannot enjoy any benefits from their investment in an IOS unless the system is adopted by customers. Implementation of these systems depends on the acceptance, adoption and use of the system by customers. This section discusses factors which affect implementation and impact adoption rates; a summary table with case results completes the section.

Adoption factors

Expressed user need. In three cases the IOS was developed in response to expressed and known customers' needs. In one of these cases (Case 3) two major customers had identified an electronic data interchange (EDI) application and approached the organization to accommodate their needs by becoming EDI partners. In the other two cases (Case 2 and Case 7) customers were known to want the service which could be supplied with the IOS: in both these cases, similar systems were already available from competitors in the industry.

In the six remaining cases, customers had not expressed a need for the IOS; none of the organizations had carried out any market research to identify if such a need existed. Many of the organizations were convinced that the systems would be adopted because that is what had happened abroad. Providing interorganizational electronic facilities was technologically possible, was beneficial for the sponsoring organization and also offered benefits to the customer. In the USA the systems had been readily adopted once customers recognized the efficiencies to be gained in their own business operations. It was apparent, from the US experience, that there was likely to be a latent, rather than expressed, user need for such systems.

User participation in development. Only four firms involved users (ie customers) in system development. Two organizations approached customers during the project definition stage of IOS development, and two other organizations sought input from potential users during design of their system. User participation in these cases was 'high' and 'moderate' respectively. All other organizations used customers during beta-testing of their systems, but not in the earlier stages of development.

Cost of system to user. Actual costs of the various systems charged to customers are not easily comparable across cases. Systems are based on different technologies ranging from a portable data entry (PDE) device to mainframe-to-mainframe EDI, and this affects the costs of the system to the customers; the total cost of obtaining a PDE is much less than the cost of preparing a system for EDI. Also, the customers of various systems range from owner-managers of small retail outlets to large retail chains. Instead of comparing cases on actual costs, cases are compared according to customer perception of costs.

On-going costs in terms of using and maintaining an IOS are usually low for the customer. The major cost issue is acquisition of the system. In none of the cases was the full cost of development passed on by the sponsoring organization to the customer: development cost was considered a necessary cost to the business. In the long run these costs may be recovered through the benefits accruing to the sponsoring company from adoption and use of the system by customers.

In spite of not passing on full development costs, two of the cases involved the customers in high acquisition costs. In all other cases acquisition cost to the consumer is moderate to low. For all systems high costs were found to be strong inhibitors of system adoption by customers. Even if customers could envisage the potential benefits from adopting the CO-IOS, the customer would still refrain from adoption on the grounds of high initial costs.

Marketing of system. There is a wide variation in the effort that sponsoring organizations put into the marketing of their IOS to customers. Some organizations make a lot of resources available and set up a separate team dedicated to the marketing and support of the IOS. Other organizations market their system in a

basic manner only, apparently hoping that the systems sell themselves. One organization (Case 3) had not marketed its IOS at all. Due to other projects having been given priority in the organization, there is no marketing plan for the system, there are no penetration targets and the system is not promoted in any way.

Technological awareness among customers. In addition to the above four factors identified in Table 2, the cases indicated a fifth adoption factor. All companies mentioned a lack of technological awareness among customers impacting on adoption of their systems by customers. Sponsoring organizations found that their customers are often unaware of the ways in which technology can improve their business operations.

The pharmaceutical wholesaler in Case 6 found it very difficult to convince pharmacists of the value of electronic ordering through PDEs: pharmacists were simply not aware of the potential impact of technology on their business. Even now, more than 10 years after the introduction of PDEs, most pharmacists are still only 'computer literate in the very general sense of the word'.

The transport operator in Case 8 found the distribution side of business is often considered to be of relatively low importance by the customers. Manual preparation of consignment notes and notifying a transport company by telephone is time-consuming but is accepted as the norm by most businesses. This had made it hard to sell the idea of computerized preparation of consignment notes and electronic consignment notification.

Adoption rate

Relative success of implementation of IOS can be measured by speed of adoption of the systems by customers. Both Reich and Benbasat (1990) and Runge (1985) used 'speed of adoption during the first year of launch' as their measure of adoption rate. For the purposes of this study, adoption rate was considered 'fast' if targets (set by the sponsoring organization) had been quickly and easily reached and if informants perceived adoption as having been fast. Adoption rate was rated 'slow' if sponsors perceived adoption to have been slow or disappointing in terms of achieving targets. Only three cases can be classified as having enjoyed relatively fast adoption of the system by customers. The remaining six systems were adopted at a much slower rate.

One example of a 'fast' adoption is the bank in Case 2. Prior to launch of their cash management system, they set a target of 40 sites in six months. This target was met within two months of launch. An example of 'slow' adoption is the transport company in Case 8. No targets had been set, but less than 30 customer sites had adopted the system three years after launch. The system sponsor commented: 'I thought they would be snapped up like hot-cakes — but it did not happen . . . '.

Summarizing implementation of the systems

Table 6 summarizes the factors impacting on implementation of the CO-IOs and the adoption rate of the nine systems in the case sample. For each factor, individual values are shown as well as positive (+) and negative (−) signs. The signs denote respectively a value expected to have a positive (facilitating) or a negative (inhibiting) influence on adoption rate; moderate values have been rated neither positive nor negative. The three cases with fast adoption rates have been highlighted by bold text.

Table 6 shows that one factor is strongly correlated with success of this

Table 6 Factors affecting successful implementation of IOS

		1	2	3	4	5	6	7	8	9
Implementation factors	Expressed user need by customer	— (—)	yes (+)	yes (+)	— (—)	— (—)	— (—)	yes (+)	— (—)	— (—)
	User participation	no (—)	moderate	high (+)	low (—)	low (—)	low (—)	high (—)	no (+)	moderate (—)
	Cost to user	low (+)	low (+)	low (+)	low (+)	moderate	high (—)	high (—)	low (+)	low (+)
	Marketing effort	moderate	high (+)	none (—)	high (+)	low (—)	low (—)	moderate	low (—)	high (+)
	User technological awareness	moderate	high (+)	low (—)	moderate	low (—)	low (—)	moderate	low (—)	moderate
Implementation measure	Initial adoption rate	slow	fast	low	fast	slow	slow	slow	slow	fast

Columns in bold type indicate cases with fast adoption rates.

development stage: marketing effort is strongly associated with initial adoption rate. There is also a clear association between the technological awareness of users (ie customers) and adoption rate and between high cost and slow adoption. Findings concerning the other adoption factors are mixed.

The data shows a mix of potentially encouraging and discouraging factors for each firm. Some cases show many negative (Cases 5, 5 and 8) or many positive (Case 2) values for adoption factors and thus fall clearly into the slow or the fast adoption category. Other cases show a mix of negative and positive values. These cases are of interest since they show that some of the factors may be more important than others.

For instance, Case 3 had a number of factors encouraging adoption: expressed user need, user participation and low cost to user. Despite this, initial adoption was slow, suggesting that the absence of marketing and low user technological awareness outweigh the other positive influences. In contrast, Case 4 developed an IOS in the absence of customer expressed need and without participation from potential users, but with low cost to the customer and with a good marketing effort was able to achieve fast adoption of the system.

Obtaining benefits from the CO-IOS

Once a system has been adopted by users, a company can begin to reap the benefits of the system. The research model identified system penetration and competitor reactions as likely to influence success at this stage. Once again, a summary table showing individual case findings for each factor, is included at the end of the section.

Factors impacting on a firm's ability to reap system benefits

System penetration. The effect of the system on the sponsoring firm depends on the number of customers adopting a system and the volume of trade taking place through the system.

Case 3, the clothing manufacturer, receives electronic purchase orders from its

two major customers. No other customers have been approached. There is no plan in place to target further customers; there is no clear top management direction and support for taking the system further. The EDI coordinator at Case 3 is disappointed with this outcome as the system is not used to its potential. In spite of a slow start, Case 6, a pharmaceutical supplier, now receives up to 87 per cent of all orders electronically. The ideal penetration of electronic order entry devices is 100 per cent, but the realistic target for electronic entry is 'somewhere in the high 90 per cent'. The system offered by Case 8, a transport operator, can be used by any customer, but the company has targeted their larger customers. Over 20 of these large customers now use the system, and the firm is confident of being able to increase this number to encompass the majority of their large customers.

Competitor reaction. Although systems can provide a competitive edge, they can be imitated as technology is available to all and at competitive prices. Therefore, competitors can acquire the technology and attempt to duplicate the IOS and offer similar facilities and services to customers, thus eroding an initial, temporarily gained advantage. First movers are clearly open to competitor reaction, but followers also provoke competitor reaction when launching their systems. Follower systems usually tried to leap-frog first-mover systems, offering more features and greater functionality and thus setting new standards for the systems in their industry. In this way, follower systems become targets for competitor reaction in their own right.

Competitor reaction was rated 'high' if the CO-IOS application and its functionalities had become a strategic necessity in the industry. Competitor reaction was also rated 'high' if competitors continually attempted to out-do each other in terms of offering increased and improved functionality. three of the seven cases encountered strong competitor reaction. Competitor reaction was rated as 'medium' if competitors are keeping up by emulating the system and are developing similar applications. Two of the seven cases could thus be classified as facing moderate competitive reaction.

Case 6 is an example of high competitor reaction. This pharmaceutical wholesaler began offering portable data entry facilities to pharmacies and all competitors followed suit. Those who did not do so within two years are no longer competing in the industry. Electronic order entry has become an industry standard; without the facility wholesalers can not compete.

In contrast, the office products wholesaler in Case 5 is an example of low competitor reaction. Their system, enabling customers to enter orders electronically, has not been duplicated by others, although their IOS has been operational for nearly five years. The technology is well-known and could be applied by competitors, but has not (yet) taken off in the industry. A major reason for the lack of competitor reaction is the fact that many of this wholesaler's competitors are small, regional firms that have no internally computerized order-processing systems.

Benefits obtained

The benefits of IOS for a sponsoring organization can accrue in many ways: the system can bring about internal cost efficiencies, increased sales, increased market share, and greater customer loyalty (Porter and Millar, 1985; Johnston and Vitale, 1988; Reich and Benbasat, 1990). Not all of these benefits are tangible and it is almost impossible to quantify the benefits in retrospect since other changes, apart

from implementation of the system, will have taken place concurrently (Johnston and Vitale, 1988). However, the case organizations were willing and able to discuss the relative success of their systems; informants reported on the impacts which they attributed to implementation of their respective systems.

Benefits were considered 'high' when informants indicated that, over time, costs had been recovered and that further benefits had been attained; benefits were rated 'moderate' where only costs had been recovered; benefits were rated as 'low' if informants reported intangible benefits only or if the system had involved the sponsoring organization in significant and tangible on-going costs which outweighed any benefits.

Case 6 is an example of a high benefit case: the organization changed from being a small, regional wholesaler into one of the two national pharmaceutical wholesalers in New Zealand. Electronic trading has allowed the company to become 'considerably more efficient' and to contain costs over time. In terms of sales volume, their IOS played a significant role in their sales growth. Electronic trading simplified order tracking for individual pharmacies and enabled the company to introduce discount structures for increased volume of trade. Since it was the first wholesaler to introduce such a scheme, the company was able to attract increased sales. Wholesalers who did not support electronic order entry went out of business and the company established itself as a major national wholesaler. Customer satisfaction increased due to quicker and more convenient ordering. The increased facilities and service possible with electronic order entry has now come to be expected by pharmacists.

The clothing manufacturer in Case 3 presents an example of a low benefit IOS. Development and operational costs have not (yet) been recovered. The only benefit of their IOS is intangible and concerns customer satisfaction: 'it enhances our trading partner relationships'. Those relationships were already strong before the EDI links but the relationships have been improved. Electronic purchase ordering has necessitated extra procedures to ensure the process works. Customers must have up-to-date prices and barcodes for all products. Because the system does not include an electronic product catalogue, a new manual system has been put in place to notify customers of deletions from, changes to and additions to the product range. The company admits that this manual system does at times lead to errors. Other benefits are not clearly evident. Unless the system is expanded to include more customers, and is enhanced by further facilities, it is unlikely that the firm can reap significant benefits.

Summarizing reaping of benefits

System penetration, competitor reaction and reaping of benefits refer to events that can only be measured after the CO-IOS has been in operation for a considerable period of time. For this reason the success of this final development stage was evaluated only for the seven organizations whose CO-IOS had been launched more than two years previously.

Table 7 shows the extent of system adoption and the relative impact of competitor reaction on the ability of firms to reap benefits from their IOS. Again, positive and negative signs indicate the expected effect of individual values of the adoption factors on the outcome of the development stage.

Success of this development stage is measured by the type and extent of benefits obtained from system use. The two cases which were most successful, in terms of reaping benefits from their IOS, are highlighted in bold type in Table 7.

Table 7 shows a high correlation between extent of system penetration and the

Table 7 Factors impacting on ability to reap system benefits

		1	3	4	5	6	7	8
Factors	System penetration	moderate	low (-)	high (+)	low (-)	high (+)	low (-)	low (-)
	Competitor reaction	high (-)	none (++)	low (+)	none (++)	high (-)	high (-)	moderate
Benefits		moderate	low	high	low	high	low	moderate

Columns in bold type indicate most successful cases.

ability of a sponsoring organization to reap benefits from an IOS. The relationship between competitor reaction and the level of success of this development stage shows mixed results.

The case evidence indicates that system penetration may be more important than competitor reaction in affecting the outcome of the last stage in IOS development. In spite of zero competitor reaction, Cases 3 and 5 can still only attribute limited benefits to their IOS while penetration of their system is low. Case 6, which has achieved a high penetration level over time and which also experienced strong competitor reaction, has been able to reap significant benefits from the IOS.

Discussion

Before discussing the results of this study, it is important to recognize the limitations of the research. All cases were New Zealand organizations. Since New Zealand is a relatively small and isolated nation, it is possible that the study contains regional bias. For example, the 'lack of technological awareness' as a factor inhibiting the implementation stage of IOS may not be as prominent in North America or Western Europe due to different educational programmes that promote awareness about information technology. Furthermore, the study looked at interorganizational systems that link firms with customers. Findings for systems linking organizations with suppliers and distributors may differ from those reported here.

Support for IOS development model

The cases provided considerable support for much of the previously reported research findings, and hence support the research model depicted in *Table 2*. The data provided evidence for 12 of the 14 factors within this model. In general, it shows that a number of variables do impact on the success of an IOS. The cases added one factor to the model in *Table 2*: customer technological awareness. Slow adoption of the systems offered by several of the case organizations can be partially attributed to a lack of technological awareness among potential users.

Table 8 summarizes the extent of support for the original research model; it includes the original 14 factors as well as the additional factor found to be impacting on implementation of systems. This slightly revised version of the original research model could be used in other studies of CO-IOS, and could provide a basis for practitioners when planning a customer oriented IOS.

Marketing of IOS systems, with an emphasis on explaining benefits to customers and on discussing impact on customers, is likely to help users to feel more comfortable with the technology. This in turn will have an effect on adoption of the system. Conversely, without marketing and without making attempts to gain

Table 8 Support for IOS development success factors

Development stages support	Factors contributing to success at each stage	Extent of success at each stage
Identifying IOS opportunities	<ul style="list-style-type: none"> • Use of frameworks • Internal need • Competitive pressure • Technological opportunity 	<p>None</p> <p>None</p> <p>Mixed</p> <p>Strong</p>
Designing and building the IOS	<ul style="list-style-type: none"> • Application sponsor • Top management support • Build on existing system • IS staff experience 	<p>Mixed</p> <p>Inconclusive</p> <p>Mixed</p> <p>Mixed</p>
Implementing the IOS	<ul style="list-style-type: none"> • Expressed user need • User participation in development • Cost of system to user • Marketing of system • User technological awareness 	<p>Mixed</p> <p>Mixed</p> <p>Mixed</p> <p>Strong</p> <p>Strong</p>
Obtaining benefits from the IOS	<ul style="list-style-type: none"> • System penetration • Competitor reaction 	<p>Strong</p> <p>Mixed</p>

customer interest, a system is not likely to be widely adopted — as is evident in the case of the clothing manufacturer in Case 3. Marketing of an IOS is very important — not only to ‘sell the system’ but also to overcome a lack of knowledge and understanding about the benefits and uses of the system.

Once a system becomes accepted by users and is adopted, the sponsoring firm can start reaping the benefits accruing from the system. One would expect a firm to reap greater benefits if little competitor reaction took place. However, the cases suggest that the benefits derived by companies were in line with the extent of adoption. Since it appears that extent of adoption has a greater effect on impact of the IOS than competitor reactions, it may be more important to attain a user base than to worry about competitor reaction.

Suggestions for further research

This research focused on factors and related them to successful completion of each phase of the development process. With the last two stages of the development process, it was possible to link factors to success, as a distinction could be made between obviously successful and clearly unsuccessful systems at these stages. Cases could not be categorized according to variable outcomes of the first two development stages, since all cases identified IOS opportunities and all cases completed the building of a system. Therefore, several factors shown in the model’s early stages may not be distinguishing features of *successful* IOS (eg top management support), but may in fact be associated with *any* IOS development. In order to research this issue, a study must include systems of clearly variable success at the early stages.

Further research could also investigate the relative importance of the factors impacting at each stage of the process. For example, previous research identified a number of factors impacting on the implementation of IOS. The case findings showed that some of these factors are not always present and do not necessarily directly influence successful completion of the implementation stage. It is likely

that some factors are more important than others. Causal modelling could indicate the relative importance of each factor. Further research might help to identify the major implementation adoption factors.

Similarly, the relative importance of variables at the design and build stage can be studied. The case evidence suggests that the presence of a high-level sponsor and the strong commitment of top management may facilitate, but are not necessary, to enable design and building of an IOS. Most cases built on existing systems and used experienced staff to develop the system. The presence of an enthusiastic sponsor and strong top management support may be more important in the absence of existing systems to build on, or in the absence of experienced staff. Further research could investigate the relative importance of the factors impacting on this development stage.

There is the potential for research to focus on specific factors, rather than attempt to consider all success factors. This case evidence suggests that marketing of the IOS is one factor which is particularly worthy of rigorous study.

Conclusion

This study set out to investigate factors affecting the success of customer oriented IOS development and used evidence of nine cases linking organizations with their customers. As shown in *Table 8* this study found support for many of the previously identified success factors. In addition to previous work, this study identified technological awareness of users as having a significant effect on adoption rates of IOS. The extent of adoption appears to be strongly related to ultimate system success, as widespread use of an IOS enables a firm to reap benefits from its IOS. The immediate benefits include the ability to contain or reduce operational costs and to increase customer satisfaction regarding service. Some IOS enhance a firm's competitive position by increasing market share and increasing a firm's volume of sales.

The second objective of this paper was to explore the relative importance of various factors. Previous research has not addressed this issue. Case evidence suggests that some of the success factors may be more important than others and that a positive value of certain factors may compensate for negative values on others. Specific suggestions have been made for further research to investigate this in greater detail.

Knowledge and understanding of the factors contributing to successful completion of each stage is important. It enables firms to ascertain their potential to develop a successful IOS. Recognizing limitations and constraints, firms may be able to effect change and thus create conditions more favourable to the successful development of the IOS. Practitioners interested in using IOS in their organizations could increase the potential success of their systems by addressing these success factors when planning their own systems.

References

- Barrett, S and Konsynski, B (1982) 'Inter-organisational information sharing systems' *MIS Quarterly* (December) 93–105
- Benjamin, R I, de Long, D W and Scott Morton, M S (1990) 'EDI: how much competitive advantage?' *Long Range Planning* 23 (1) 29–40
- Cash, J I and Konsynski, B R (1985) 'IS redraws competitive boundaries' *Harvard Business Review* (March–April) 134–142

- Cavaye, A L M (1993) User participation in the development of inter organisational systems and its effect on the success of such systems. Unpublished PhD thesis, University of Waikato, Hamilton, New Zealand
- Cavaye, A L M and Cragg, P B (1993) 'Strategic information systems research: a review and research framework' *J Strategic Information Systems* 2 (2) 125-137
- Ciborra, C U (1991) 'From thinking to tinkering — the grassroots of strategic information systems' *Proc Twelfth International Conference on Information Systems* New York (December) 283-292
- Clemons, E K and Row, M (1987) 'Structural differences among firms — a potential source of competitive advantage in the application of information technology' *Proc Eighth International Conference on Information Systems* Pittsburgh (December)
- Clemons, E K and Row, M (1988) 'McKesson Drug Company: a case study of Economost — a strategic information system' *J Management Information Systems* 5 (1) 36-50
- Copeland, D G and McKenney, J L (1988) 'Airline reservations system: lessons from history' *MIS Quarterly* 12 (3) 353-370
- DeLone, W H and McLean, E R (1992) 'Information system success — the quest for the dependent variable' *Information Systems Research* 3 (1) 60-95
- Galliers, R D (1991) 'Strategic information systems — myths, reality and guidelines for successful implementation' *European Journal of Information Systems* 1 (1) 55-64
- Ives, B and Learmonth, G P (1984) 'The information system as a competitive weapon' *Communications of the ACM* 27 (12) 1193-1201
- Ives, B and Vitale, M R (1988) 'After the sale: leveraging maintenance with information technology' *MIS Quarterly* 12 (1) 7-12
- Johnston, H R and Carrico, S R (1988) 'Developing capabilities to use information strategically' *MIS Quarterly* 12 (1) 36-48
- Johnston, H R and Vitale, M (1988) 'Creating competitive advantage with inter information systems' *MIS Quarterly* (June) 152-165
- Kaufman, F (1966) 'Data systems that cross company boundaries' *Harvard Business Review* (January-February) 141-155
- King, W R and Sabherwal, R (1992) 'The factors affecting strategic information systems applications — an empirical assessment' *Information and Management* 23 (4) 217-235
- Miles, M B and Huberman, A M (1984) *Analyzing Qualitative Data: A Source Book of New Methods* Sage Publications, Beverley Hill, CA
- Neo, B S (1988) 'Factors facilitating the use of information technology for competitive advantage — an exploratory study' *Information and Management* 15 191-201
- Porter, M E and Millar, V E (1985) 'How information gives you a competitive advantage' *Harvard Business Review* (July-August) 149-160
- Reich, B H and Benbasat, I (1990) 'An empirical investigation of factors influencing the success of customer oriented information systems' *Information Systems Research* 1 (3) 325-347
- Runge, D (1985) Telecommunications for competitive advantage. Unpublished PhD thesis, Templeton College, Oxford
- Suomi, R (1992) 'On the concept of inter organisational information systems' *J Strategic Information Systems* 1 (2) 93-101
- Yin, R K (1989) *Case Study Research — Design and Methods* (revised edition), Sage Publications, Newbury Park, CA