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# The Impact of IOS-Enabled Business Process Change on Business Outcomes: Transformation of the Value Chain of Japan Airlines

AKEMI TAKEOKA CHATFIELD AND NIELS BJØRN-ANDERSEN

AKEMI TAKEOKA CHATFIELD is a Research Fellow at the Fujitsu Centre for Managing Information Technology in Organisations at the Australian Graduate School of Management, Sydney. She holds a Ph.D. in MIS from Texas Tech University. Her research focuses on the management of interorganizational systems, IT-enabled business network redesign, and knowledge management, particularly in the domain of interfirm joint product innovation. Dr. Chatfield has published articles in journals such as *Communications of the ACM*, *Database*, *Journal for Management, Informatics and Personnel*, and others. Her work with Niels Bjørn-Andersen has been published in *EDI in the Public Sector: Governmental Action, Diffusion, and Impacts*, edited by K. Viborg Andersen. She recently served as IT adviser to the Australian government in its trade-related EDI initiative to redesign intergovernment trade documents exchange processes with the Japanese government.

NIELS BJØRN-ANDERSEN is a Professor of Information Systems at the Department of Informatics and Management Accounting, Copenhagen Business School. He received his M.Sc. and his Ph.D. from Copenhagen Business School, where he has worked ever since, except for visiting positions at the Australian Graduate School of Management in Sydney, Manchester Business School, Paris Université IX Dauphine, University of California at Irvine, and elsewhere. His current research interests include utilizing IT in creating new organizational forms, business process reengineering, and managing the IT function.

**ABSTRACT:** This paper explores the relationship between IOS-enabled business process change and business outcomes. A generic framework for analyzing IT-enabled business process change is applied to a case study analysis of Japan Airlines (JAL). Drawing on a resource-based view of the firm, we investigate the ways in which IOS not only contributed to JAL's improved competitiveness but also enabled it more fully to leverage its strategic value chain as an engine of growth and a new source of competitive advantage. Our focus is on JAL's strategic use of the AXESS Computer Reservation System and Electronic Data Interchange, developed with a clear strategic intention to support JAL's emerging strategies on customer service, sales, value chain logistics coordination, and cost reduction. JAL's collaboration with the IOS-transformed virtual value chain firms significantly contributed to JAL's business growth and competitiveness. JAL's time-based competitiveness has been improved through its IOS-enabled interfirm joint product innovation cycle time reduction.

**KEY WORDS AND PHRASES:** business process change, computerized reservation systems, electronic data interchange, interorganizational systems, product innovation cycle time, resource-based view of the firm, time-based competition, virtual value chain.

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SINCE THE EARLY DAYS OF COMPUTERIZATION, there has been significant interest in “the impact of computers on organizational structure” [34], “the interaction of IT and organizations” [32], “the alignment of organizational infrastructure and IT strategy” [37], the “organizational metamorphosis” [6], and “contradictory organizational consequences of information technology” [55].

These all focus on the *intraorganizational* issues of the individual firm. The environment has been treated as an exogenous given variable, not to be changed or tampered with. Notable exceptions focusing on the *interorganizational* issues are publications such as (1) “IT in the 1990s: Managing organizational interdependence” [56], which is one of the first articles to discuss interorganizational systems (IOS); (2) “The IT-induced business reconfiguration” [65], where IOS are explicitly seen as a significant enabler for business network redesign; and (3) “The role of IT in organizational design” [36], where different types of new organizational forms including virtual, negotiated, and vertically integrated conglomerates are explicitly using IT in organizational transformation in different ways.

Interestingly, there is growing consensus that IOS will have a significant impact on value chain management as well as on the relationships within the value chain [10, 33, 44]. Conspicuously absent in the IOS literature, however, is case study analysis of the impact of IOS-enabled business process change on business outcomes. Extant studies do not explain how the focal firm’s ability to exploit IOS affects its interdependent relationships with the network of firms in the purchase and sales value chains, particularly with respect to the exchange of information and knowledge required of the value-added interfirm collaboration and innovation. Furthermore, relatively little is known about how the focal firm can leverage IOS-enabled business process change to improve its business outcomes, for example, through exploiting their value chains for cost reduction, customer service, quality, cycle-time reduction, and new product development.

The purpose of this paper is to explore the relationship between the focal firm’s ability to exploit IOS-enabled business process change and business outcomes. We apply a generic framework for analyzing IT-enabled business process change that has been developed to explain the role of IT in creating the twenty-first-century organization [4, 5], to a specific case study analysis of the transformation of the value chain on business outcomes through the strategic use of IOS by Japan Airlines (JAL), the world’s third largest airline in 1994 [17]. We are particularly interested in the ways in which IOS not only contributed to JAL’s improved competitiveness but also enabled it to leverage its strategically important value chain as an engine of growth and a new source of sustainable competitive advantage.

Drawing on a resource-based view of the firm [1, 7, 46], we analyze JAL's unique and valuable resources, namely IOS ("physical capital resources"), which enabled the top-down design of radical change in core business processes, and people ("human capital resources"), who, over time, carried out the change incrementally from the bottom up. The results were JAL's business growth and increased competitiveness, despite intensive competition in both domestic and international markets since the 1980s and the weakened economic conditions in Japan during the early 1990s. The focus is on JAL's strategic use of IOS, particularly the AXESS Computer Reservation System (CRS) and electronic data interchange (EDI), developed with a clear strategic objective of supporting JAL's emerging strategies on customer service, sales, value chain logistics coordination, and cost reduction. As part of this focus, we discuss JAL's exploitation of IOS-enabled networked value chain firms to reduce joint product innovation cycle time to market.

## A Framework for Analyzing IT-Enabled Business Process Change

THE FRAMEWORK APPLIED TO EXPLORE JAL'S IT-ENABLED business process change here is based on the generic framework for analyzing the role of IT in creating the twenty-first-century organization [4, 5]. This generic framework has been developed to explain the interdependent relationships among the global environment, business challenges, strategic responses, strategic IT support, and management methodologies that enable changes in business processes and the impact of radical organizational transformation on the firm's business outcomes. Although the generic framework has not been rigorously validated, it has high face validity since it has been successfully used to discuss the firm's business process change and business outcomes with managers of a number of firms in Denmark, Australia, and Japan.

The framework is shown in figure 1. The context is first and foremost the increasingly global environment for any organization, which translates into a set of unique business challenges for any organization. These business challenges typically require a strategic response in the form of changed business processes primarily enacted through the use of different management methodologies and different IT-systems.

We begin by briefly describing the core concepts in the framework, drawing in particular on examples pertaining to the airline industry (see [4] for a detailed discussion of the framework).

### The Global Environment of the Twenty-First-Century Organization

The past two decades have brought dramatic changes in the global environment of almost all major organizations. This is to a large extent a result of a deliberate policy of *deregulation* in most sectors of the economy: trade, services, financial markets, and foreign investments. Most dramatically, this is taking place within the large trading blocs (European Union, NAFTA, and the AFTA/APEC), but also the Uruguay Round and the continuation of these multilateral trade negotiations on bilateral levels (e.g., EU and United States), as well as at the GATT and G7 level, have significantly changed

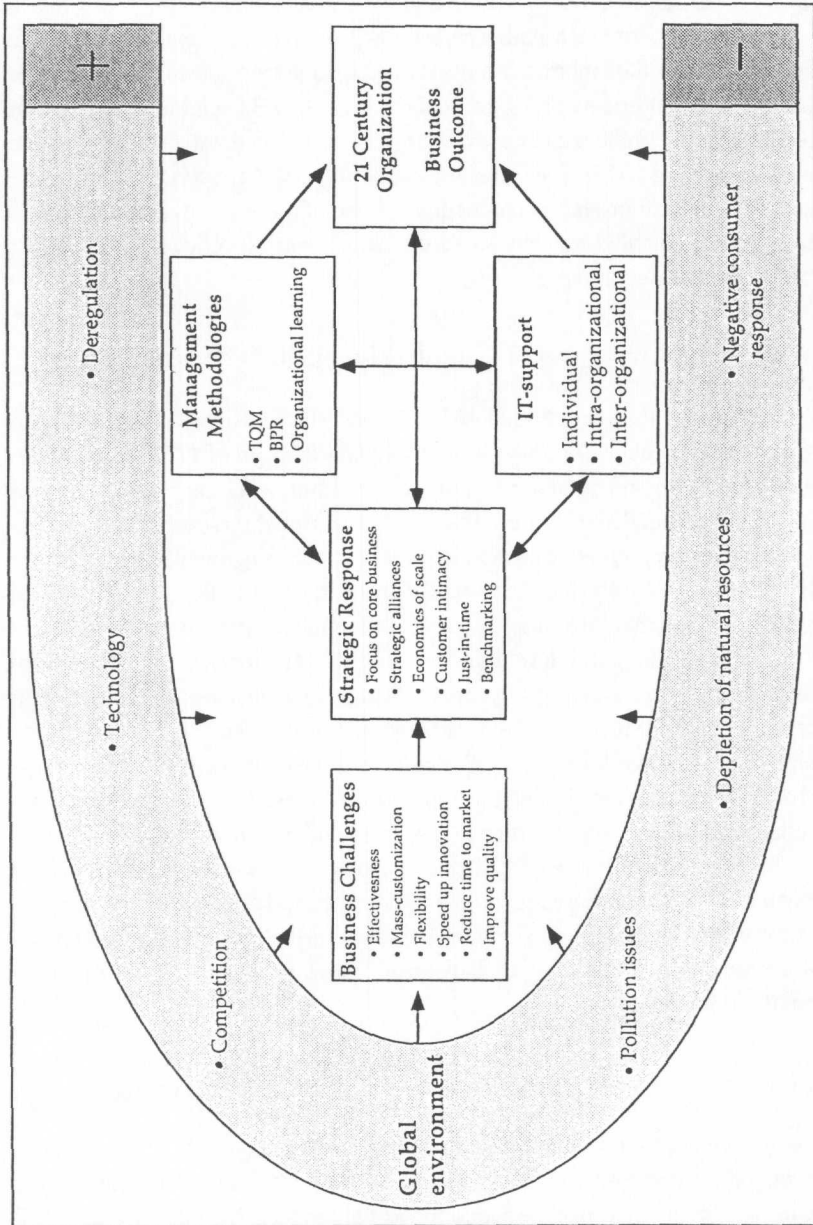


Figure 1. Framework for Analyzing IT-Enabled Business Process Change

the conditions for doing business. Within the airline industry, this has led to dramatic deregulation and removal of the traditional exclusive rights of airlines to certain routes.

The U.S. airline industry was deregulated in 1978, the Japanese airline industry in 1985, and the European airline market in 1997. The U.S. deregulation resulted in intensified competition [41, 45], while the Japanese deregulation led to growing competition among domestic carriers but reduced the scale economies in their cost structure [31]. Very few observers inside the industry doubt that the deregulation will eventually span the globe for all major routes. There are, however, still substantial barriers to free competition in the form of landing and departure slots and terminal facilities.

*Technological progress* within IT/telecommunication and transport is the main reason the deregulation is having this enormous impact, which will be even more significant with the deregulation of 90 percent of all telecommunications in the world decided in February 1997. Geographical distances become less and less of a barrier to new product and market development, and there is a distinct increase in globalization of markets and competition. In the airline market, the advances in communication, navigation, and aircraft design especially shape the *competition*. In the intensely competitive airline industry worldwide, even the number of airlines often fluctuates as low-cost airlines enter, in some cases taking significant market share from the well-established airlines.

While these three factors—deregulation, technological progress, and competition—all contribute to continued expansion, there are several barriers to the “unlimited Ikaros line” of continued growth [39].<sup>1</sup> We have grouped these into three categories: pollution, depletion of resources, and negative consumer response. The growing problem of airport noise, fuel resource depletion, and negative consumer response to fatal airline crashes are important issues for the airline industry. A fatal JAL crash in 1985 drastically reduced sales, resulting in the first net loss in the firm’s history since 1953. They are not, however, a central thrust of our paper and therefore are not discussed in detail here.

## Business Challenges for the Twenty-First-Century Organization

The elements mentioned above constitute the global environment of an organization and, hence, give rise to new business challenges. Obviously the intensity and relevance of each of these elements vary from organization to organization. However, many organizations are facing the following business challenges:

- Increase effectiveness and quality in products and services: From public sector to private enterprises there is an increasing pressure to “get more for less” [13, 22, 49]. Within the airline industry there are nearly daily stories about airlines being forced to cut costs to stay competitive.
- Enable mass-customization: This is found in products as diverse as tailor-made Levis and cars made to customer specifications [22, 48, 58]. The attempts in the airline industry to differentiate prices and add-on services are examples of coping with this challenge.

- Increase flexibility in response to changing market conditions: Airlines operating in a deregulated market must constantly be prepared to change routes, alliances, catering, and loyalty schemes [13, 24, 29].
- Speed up innovation in order to gain a competitive edge [13, 24, 30]: This is a particular challenge to all R&D-intensive industries—not only pharmaceutical and electronics companies but airlines as well.
- Reduce cycle time from production to market: The shorter the time lag, the lower the level of intermediate stock and less risk of supplying the wrong products, especially in the fashion industries (e.g., Benneton). For the airline industry, it is product innovation, the load factor, and the utilization of the aircraft that make the difference [8, 29].
- Improved quality and zero defect: These are becoming much more than buzzwords in the products as well as in the full procurement process in almost all industrial sectors, and airlines that cannot meet these requirements face significant problems [13, 14].

### Strategic Response for the Twenty-First-Century Organization

Every organization has to find its own unique set of strategic responses to its business challenges. Figure 1 shows the strategic responses that are most frequently made: focusing on core business through outsourcing, leveraging through strategic alliances, creating customer intimacy, and being just-in-time. We return to these in detail when we discuss the strategic responses of JAL to changes in its global environment and its specific challenges.

### IT Support for the Twenty-First-Century Organization

There is widespread support in the IT management literature for the notion that IT can significantly enable the strategic response [37, 51]. In our framework, we have found it useful to distinguish among IT support on three levels: individual personal productivity tools, *intraorganizational* systems typically supporting work groups, and *interorganizational* systems crossing organizational boundaries. Since this paper focuses on the virtual value chain between JAL and their strategic value chain firms, we concentrate on the *interorganizational* systems.

### Management Methodologies for the Twenty-First-Century Organization

There is a plethora of management methodologies proposed as the (often one and only) candidate for how to achieve the result we call the twenty-first-century organization. In the framework we specifically mention total quality management (TQM), business process reengineering (BPR) and organizational learning (O/L), but there are obviously many more worth mentioning. Our point is that, in their attempts to meet the business challenges in the form of unique strategic responses, organizations apply a

combination of different management methodologies as well as IT systems. Most of the time these are bundled to create a dynamic effect where it is difficult to identify empirically the exact systemic effect of a particular management methodology.

Before we apply this generic framework to analyze JAL's IT-enabled business process change and its impact on their business outcomes, we discuss case study analysis as the methodology chosen for this study.

## Methodology

GIVEN THE DEARTH OF FIELD RESEARCH IN THE AREA of the impact of IOS-enabled business process change on business outcomes, we chose an exploratory research approach. Case study analysis is particularly useful for studying organizational dynamics, especially the context and process of change [19, 20, 47]. The importance of grounding theory development in the detailed case data has been recognized in management and IS fields [63, 68].

Because our study is exploratory, data collection consisted of fourteen detailed unstructured interviews with managers from JAL during June and July 1994. A further seven interviews were conducted with managers from the JAL Group firms specifically to explore the interdependent relationship issues between their firms and JAL during June 1995. These unstructured interviews were not guided by the framework since it was developed later. Numerous followup telephone calls took place to clarify the research notes taken during the interviews.

In addition to the primary data collected during the interviews, we have analyzed the longitudinal financial data (1987–94) such as operating revenues, operating expenses, number of employees, other performance measures from *JAL Annual Reports* (1987–94) [28] as well as other secondary data sources, such as *IATA Members' Statistics* (1987–94) [27]. Furthermore, we have analyzed over sixty of the available external reports published in Japanese on JAL or the JAL Group, including trade journals (e.g., *Travel Journal*, a Japanese weekly travel trade journal) and business newspaper and magazine articles (e.g., *Nikkei Business* and *Nikkei Shimbun*) on their customer services, new product introduction, and new market development. These publications were obtained from commercial information services (e.g., Nikkei business data services) and from a key word search of Japanese libraries databases.

## JAL Company Background

SINCE 1953, UNDER THE JAPAN AIR LINES COMPANY LIMITED LAW ("the JAL Law"), JAL was granted a special corporate status to operate international air services as the Japanese flag carrier. Until the deregulation of the Japanese airline industry in 1985, there was a clear division of labor: JAL was the only domestic airline that was authorized to operate international routes. Other airlines such as All Nippon Airways (ANA) and Japan Air Systems (JAS) were allowed to operate only in the domestic market. The company, as a semiprivate corporation, had the Japanese government as its largest stockholder. Its normal operations received detailed scrutiny from govern-

ment, ranging from needing the transport minister's approval to increase capital, issue bonds, or take out long-term loans to operational guidelines suggesting what food could be served to first-class passengers. This level of governmental control eroded much of the firm's managerial independence and created excessive complexity. This resulted in a highly bureaucratic, inefficient organizational structure with unnecessary divisions and layers.

With the Japanese government's long-held policy of protectionism, it was easy for JAL to become complacent and noncompetitive in customer service and cost structure. The company viewed its mission as a provider of *air transport routes* (a market *product focus*) for passengers and cargo, rather than a provider of *customer service* (a customer service *process focus*). Given its stated mission, it was not surprising that the company was not customer-oriented in the 1980s. The company's customer service vis-à-vis that of domestic competitors was rated among the domestic travelers who were surveyed in 1986 as bureaucratic and unfriendly [67].

On the other hand, JAL sustained its position as a market leader in engineering, safety standards and information technology. In Japanese society, where the status of employees is closely linked to the social status of their firm [42], JAL attracted high-quality graduates in specialized fields such as engineering, computer sciences, operations research, economics, and finance from the best universities because of the firm's prestigious social status as the Japanese flag carrier. Like other large Japanese firms, JAL offered these employees very high job security and lifetime employment, except in the event of a severe economic crisis. JAL also provided "continuous training," through job rotation, systematically exposing people to all the jobs within a specialty as well as to other major functional areas of the business [15].

In return, JAL demanded loyalty, service, and learning of specialized knowledge and skills from their employees, which is not easily transferable to other employment (e.g., tacit knowledge of managing a specialized supplier for JAL). These Japanese institutional structures [15, 18, 25] helped JAL develop "strategically valuable human capital resources," which provided JAL with the capabilities necessary to develop IOS, integrate IOS with internal IT, successfully promote an IOS network to their intended value chain firms, and exploit IOS in the mutually interdependent relationships with their strategically valuable value chain firms.

In November 1987, primarily as a result of competitive pressures from U.S. airlines, abolition of the JAL Law and the sale of stock held by the government effectively privatized JAL. Privatization provided JAL with not only the capital it needed but also an opportunity to reassess the way it had done business for the previous thirty-four years under the government's regulation and protection.

JAL has developed interfirm networks, commonly referred to as the "JAL Group," which are a critical source of value in JAL's value chain. The JAL Group includes over 130 companies in which JAL directly or indirectly owns an average equity interest of 20 percent. It comprises two subgroups: firms closely linked to the air transport industry and firms outside the industry. The first group includes management and marketing of package tours, ground handling, in-flight meal services, aircraft maintenance, and fueling services. The second group includes hotels, information



technology and communications services, trading companies, and cultural enterprises.

The JAL Group is a *keiretsu*-based value chain for JAL. Keiretsu are a group of individual firms viewed together because they are affiliated with a large focal firm. In the case of the JAL keiretsu, it is a leading vertical keiretsu, where JAL is the hub of its hierarchical organizational form. The JAL keiretsu, differs from the Big Six, powerful bank-centered keiretsu: Mitsui, Mitsubishi, Fuyo, Sumitomo, Daiichi Kangyo, and Sanwa.

## A Case Study Analysis of JAL's IOS-Enabled Business Process Change

WE NOW APPLY THE GENERIC FRAMEWORK PRESENTED EARLIER to a case study analysis of JAL's IOS-enabled business process change. More specifically, we analyze each of the components of the framework: JAL's global environment, business challenges, strategic responses, strategic use of IOS, management methodologies, and business outcome. Our analysis is summarized in figure 2.

In the time-based competitive airline industry, JAL's quick customer response critically depends on the capabilities of the JAL Group firms. The supplier value chains are important for better efficiency and effectiveness of JAL's purchase of products and services (e.g., cabin food) from the value chain firms in the upstream and JAL's sales and distribution of the firm's end products (e.g., airline seat and tour package) in the downstream. In this time-based competitive environment, the efficient and open exchange of information and knowledge between the focal firm and their value chain firms is a source of sustainable competitive advantage [8, 9, 59, 60, 61].

### JAL's Global Environment in the 1980s

The past two decades have seen significant transformations in both JAL's immediate and remote environments. In the remote environment, the deregulation of the U.S. airline industry in 1978 led to increasingly intense time-based competition [38]. Under the growing competition, large airlines invested in computerized reservation systems (CRS) development, which made the airline industry worldwide highly information-intensive [12, 41, 45].

Similar transformations have been seen in the immediate environment of JAL. As in the U.S. airline industry, the deregulation of the Japanese airline industry in 1985 led to growing competition among the big three air carriers but substantially reduced the scale economies in their cost structure, in effect reducing the individual airline's profitability [31].

Technological progress influencing JAL as well as the competitors has been made with respect to aircraft design and manufacturing, innovative navigational systems, and sophisticated telecommunication systems, which affect fuel economy, operational safety, and industry cost structure. Furthermore, technological progress in information technology, particularly CRS, has even more significantly influenced the nature of competition in two important ways. First, the airline industry has become much more information-intensive and more dependent on IT for much of its business. Second,

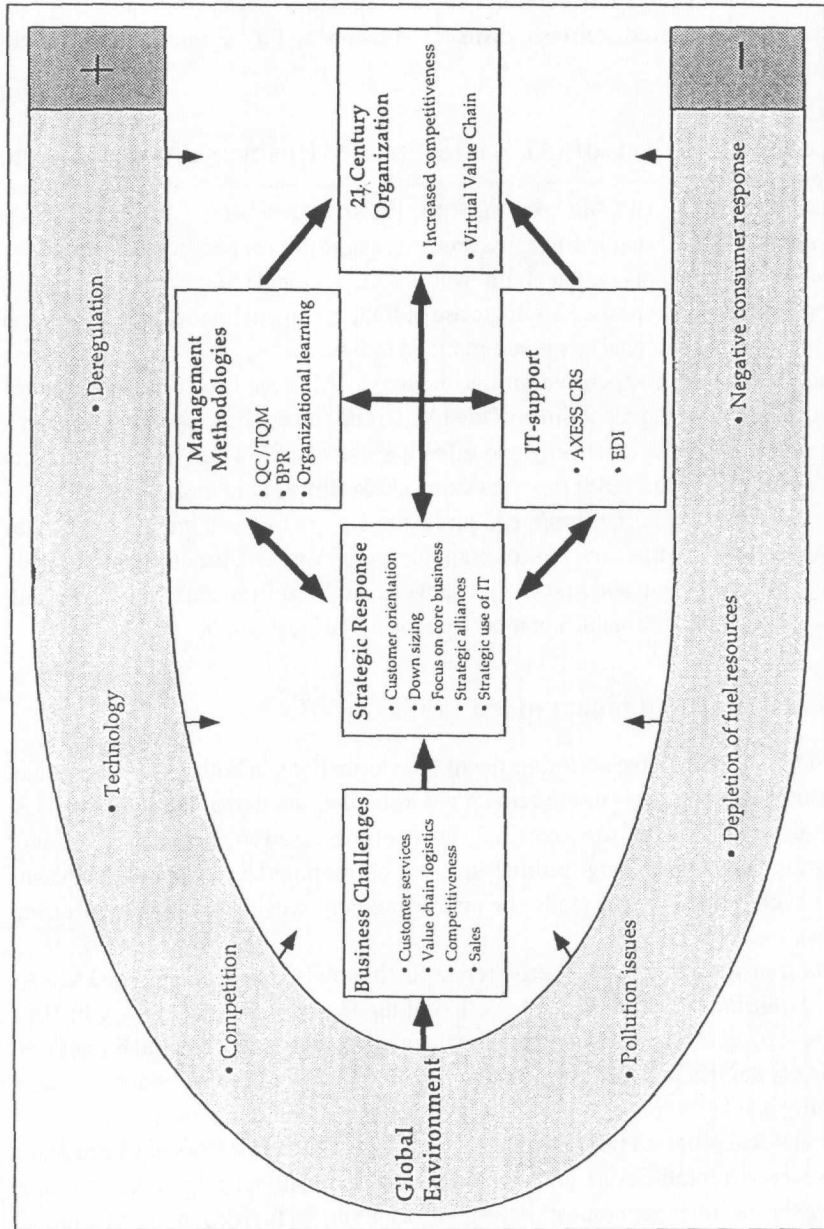


Figure 2. Modified Generic Framework Illustrating JAL's Use of IOS to Leverage Its Business Processes and Improve Business Outcome

JAL, along with other successful large air carriers, is operating in increasingly time-based competitive domestic and global markets [12, 41]. For JAL, these changes indicate the importance of leveraging their strategic value chain firms for capabilities not only to speed up their customer service (e.g., quick response to reservation inquiry) but also to accelerate innovative product development cycle time and time to market for these innovative products and programs.

Both the deregulation of the airline industry and the interfirm electronic network links provided by CRS and other IOS have accelerated the increased rate of competition in the airline industry.

## Business Challenges

All of the above factors, but especially the deregulation of the Japanese airline industry in 1985 and the proliferation of CRS worldwide in the 1980s, have intensified competitive pressures from foreign carriers and governments, who demanded greater access to major international gateways in Japan. In 1986, United Airlines, the largest air carrier at the time, inaugurated flights on Pacific routes, while All Nippon Airways (ANA), JAL's major domestic competitor, began flights to Los Angeles and Washington, D.C. In addition to the intensifying international competition, the sharp decline in demand following the fatal JAL aircraft crash in 1985 reduced the company's operating income by 49.6 percent from the previous year. As a result, the company registered a net loss of 6.7 billion yen (US\$37 million) after taxes in 1986.

A new top management team was appointed in December 1985, including Susumu Yamaji, president and operations and engineering, and Matsuo Toshimitsu, executive vice president, corporate marketing, associated business administration and development. Yamaji was a newcomer to JAL management, while Toshimitsu worked for JAL as managing director and vice president, marketing and sales, since the early 1980s. From analysis of JAL's operations and its global environment, the new top management recognized two emerging trends in Japan: (1) the Japanese economy would sustain profitable growth at a steady rate, but (2) the continued growth would require increasingly closer links with the rest of the world. It was clear that the potential for JAL was there, but the airline had to face a totally new set of business challenges in order to harvest the potential benefits.

The most important business challenges emanating from the global environment could be grouped into four groups:

- Improve customer service;
- Improve value chain logistics;
- Increase competitiveness; and
- Increase sales.

The first two business challenges were more specific in focus and might influence the latter two. Because top management considered these challenges critically urgent, JAL undertook the challenges concurrently.

The general perception of customers was that JAL was a fairly bureaucratic but very

safe and dependable airline company. But customer service left much to be desired. The other three business challenges are in part related. The value chain logistics had to be rationalized. Most organizational structures and business processes for JAL were far too complex, with substantial redundancy. In addition, there were too many different business units and employee productivity was low. In the days of a very regulated airline market, JAL's growth had to a large extent been through acquisition of airline-related businesses. Many of these businesses were potentially of strategic value, but JAL was finding it difficult to realize those strategic benefits because of the complexity involved in coordinating the different types of business. Furthermore, costs were high. U.S. airlines were far more competitive (having been deregulated since 1978) [12, 17], and, in a totally deregulated market, JAL would suffer. Unfortunately, substantial cost savings could not be achieved without downsizing, which was almost unheard of in the traditional Japanese culture.

In general, the major business challenges to JAL were radically to rethink the business it was in, to develop a new corporate vision, and to develop a strategic plan capable of handling the transformation.

### Strategic Responses

The major challenge for the new management team, according to Yamaji, was to create and implement a new corporate vision throughout JAL and the JAL Group, JAL's strategic value chain. The vision was to "build a leaner, more responsive, and customer oriented airline," while sustaining and strengthening its position as a market leader and improving its profitability. The new management strategy exploited the company's unique strengths: well-trained, loyal employees and complementary core capabilities of the value chain firms. The new strategies included:

- Focus on core business;
- Organizational restructuring;
- Downsizing;
- Customer orientation;
- Strategic partnerships; and
- Strategic use of IT.

The top management team decided that corporate organizational restructuring was a competitive necessity that had to be started immediately but would take place over many years. Restructuring was to simplify JAL's complex organizational structure and operational procedures. JAL's organizational structure has been redesigned to remove excessive redundancy and unproductive layers. Operational procedures were simplified by outsourcing a large number of service functions and by reducing the enormous amount of paper-based transactions. These decisions reduced the number of administrative as well as reservations and sales office personnel, which enabled the company to reduce operating costs, including labor costs, the second-highest cost in the airline industry. These changes in business processes were achieved without the active role of IT. However, management decision to reduce the paper-based transac-

tions led to the development of EDI applications (e.g., order entry and invoice) in a short period of time.

With a new organizational structure, top management decided to broaden its corporate earning base by promoting greater diversity and synergy with its inter-organizational value chains, where more strategic partnership characteristics should be cultivated and developed. They decided to start with some of the over 130 JAL Group firms, but later they gradually increased the cooperative efforts with other suppliers in the value chains.

In addition, in order to compete in the deregulated market, JAL had to become more customer-oriented. The most profitable customers were not prepared to put up with "monopoly-type service." Several measures such as leasing CRS terminals to large firms' in-house travel centers were taken in order to meet the demand of increasingly sophisticated business travelers.

Finally, as we shall discuss further below, top management recognized very early that it was necessary to use IT strategically. The value to U.S. airlines of the reservation systems was explicitly recognized, and JAL management launched a costly but necessary initiative to develop its own reservation system in conjunction with the new interorganizational systems.

## Strategic Use of IOS

JAL's strategic use of IOS has been strongly tied to the top management vision discussed earlier: its strategic intention to build a leaner, more responsive, and customer-oriented airline. Table 1 shows IOS support at JAL. The two most important IOS identified here are electronic data interchange (EDI) and computer reservation systems (CRS). JAL's strategic use of EDI was focused on value chain logistics coordination and cost reduction. Like other airlines, CRS was exploited for sales and customer service.

### EDI for Value Chain Logistics Coordination

The more than 130 JAL Group firms have long-established relationships with JAL as suppliers on the value chain, outsourcing vendors, or joint-venture partners. A proprietary EDI was initially developed to network JAL and the JAL Group firms electronically in order to improve their coordination efficiency in managing large-scale interdependent business activities and communications between the various relationships: supplier value chain logistics for procurement and just-in-time delivery, outsourcing service functions, and joint-venture operations.

EDI provides JAL and the companies in the value chain with timely and accurate information (e.g., flight schedules, purchase orders, cost structures), which is essential for JAL to manage the complex value chain logistics required by flying operations, including procurement and just-in-time delivery of aircraft fuel, aircraft repair parts, cabin food catering, and other customer requirements. In addition, EDI provides JAL and outsourcing vendors at home and overseas with timely and accurate maintenance

Table 1. Strategic Use of IOS at JAL

Business challenges	IOS types	Users	Business processes
Improve customer services	CRS	Travel agents, corporate travel centers, leisure travelers using AXESS Miniterminals located at train stations & convenience stores, etc.	Provide information for travel planning & make reservations for airlines, tours & hotels
	CRS	JAL	Provide travel agents with customer profile for better customer services & make reservations for airlines, tours & hotels
Improve value chain logistics coordination	EDI	JAL, the JAL Group & others in the value chains	Coordinate the value chain for procurement & just-in-time delivery of aircraft fuel, aircraft repair parts, cabin food, beverages, etc.
	EDI	JAL	the JAL Group & others in the value chain
	CRS + EDI	JAL, the JAL Group & others in the value chain	Coordinate the value chain for scheduling & operations of integrated tour packages & cargo transport
Increase competitiveness	EDI	JAL, the JAL Group & others in the value chain	Reduce operating costs through fewer paper-based transactions & reduction of administrative staff & reduce transaction costs, especially search & coordination costs
	CRS + yield mgt. system	JAL	Create new business value
Increase sales	CRS	JAL & travel agents	Make sales
	CRS	JAL	Manage marketing channels & provide training for travel agents

records. Furthermore, systems integration of CRS with EDI enables JAL and joint-venture partners to share business information required for optimal scheduling and high-yield operations of integrated tour packages, as well as efficient handling of domestic and international cargo.

This EDI network is supported by Multi Japan Network, which is owned by JAL and operated as a value-added network (VAN). Because this VAN was proprietary, the networked firms had greater trust in system and data security than they would have

if the EDI network were serviced by an independent VAN operator. In part because these value chain firms were confident about the network security—hence about the safety of proprietary information exchange through the network—and in part because they had long-term interdependent relationships with JAL, they have been quickly sold on the EDI network sponsored by JAL.

The IOS literature has shown a number of EDI “failures” where sponsor firms failed to realize the intended strategic benefits, except improved operational efficiency [2, 3, 33]. The very high degree of diffusion seen in this case study is important for the sponsor of an EDI network to realize the intended EDI benefits. Should JAL experience a significant level of resistance or delay among its value chain firms, JAL’s coordination costs would be higher and its value chain logistics coordination would be less efficient.

### EDI for Cost Reduction

In the fiercely competitive airline industry, the costs of flying operations, principally fuel costs, present the largest proportion of total operating expenses. Profitability is critically dependent on the company’s strategy to search fuel sources globally and procure bulk fuel at competitive costs. Furthermore, profitability is also influenced by the ability to manage the complex logistics of distributing fuel from the company’s own fuel supply facilities, such as those in Los Angeles, to airports worldwide in a just-in-time manner.

As JAL’s business has grown, JAL’s fleet has largely increased in number over the period analyzed. In light of this rapid business expansion, JAL had to improve its IT support functions to provide timely and efficient aircraft maintenance. EDI facilitates the communications required of the timely procurement and just-in-time delivery of repair parts required by aircraft maintenance teams. In addition, EDI provides maintenance teams around the world with accurate information on safety standards, aircraft maintenance requirement specifications, and aircraft maintenance history, which can be downloaded from the corporate databases.

### CRS for Sales

In 1987 JAL developed AXESS, an advanced and comprehensive CRS. AXESS was viewed as a key enabler for radically restructuring JAL for the business challenges it faced as a result of privatization and managerial independence. The AXESS project, at first promoted as a marketing initiative, received top management support. A high level of initial investment in capital (approximately 130 billion yen—US\$1 billion) and human resources was mobilized to ensure its timely completion. Unlike many IT development projects, the AXESS project was completed on time. The timely completion and successful implementation of the reservation system were explicitly mandated by top management as a competitive necessity to support JAL’s emerging strategies.

Top management saw Sabre and Apollo as key enablers for American Airlines’ and United Airlines’ (respectively) increased competitiveness and regarded AXESS as

“the most strategically crucial system” for JAL’s competitiveness, particularly to gain a competitive advantage in the international market. This is how Yamaji articulated his strategic intent: “With privatization just around the corner, a new program to consolidate our sales network will play an important role. We must offer new and improved services that are more receptive to the needs of the traveling public and of travel agents. These services must compete with the Apollo reservations and sales systems, adopted by United Airlines and with the Sabre systems offered by American Airlines” [28].

AXESS is an online, mainframe-based, integrated travel information and reservation system that is linked with hotel chains worldwide, as well as with foreign carriers’ CRS. As such, it became JAL’s valuable and rare physical capital resource, since domestic competitors’ CRS did not match AXESS in terms of advanced technological capabilities and system integration with JAL’s other strategic information systems (e.g., yield management). As an advanced fare-quotation and reservations system, it has a database storage capacity of 300,000 city pairs and over 8 million different types of data. AXESS effectively reduced airline ticket processing time from fifteen minutes to five seconds at the time of implementation. Besides the increased efficiency, the new CRS had certain innovative features such as being the first Japanese-language database as well as allowing information retrieval in either Japanese or English displayed on color, split windows. When AXESS was marketed to Japanese travel agents in 1988, these innovative features provided JAL with a prime-mover advantage.

### CRS for Customer Service

Figure 3 shows the comprehensive functional capabilities of AXESS. AXESS CRS was integrated with internal IT. They provided travel agents with online access to information retrieval and reservation systems for Japanese-language package tours and a passenger information management system for better customer service (e.g., customer intimacy and quick response). JAL’s implementation of Japanese-language databases enabled travel agents to access an enormous amount of travel information for their Japanese business and leisure travelers. To further improve travel agents’ performance, JAL added functional enhancements including a travel agent back office accounting system for sales productivity and a travel agent customer profile management system for customer service efficiency.

The impact of JAL’s IOS leverage on business outcomes is discussed in the discussion section of the paper. The consensus among the managers interviewed at JAL for this study was that the realization of their strategic vision would have been difficult, if not impossible, without JAL’s new IOS.

### Management Methodologies

As discussed earlier, JAL was once a semiprivate special-status company whose largest shareholder was the Japanese government. This background fostered the bureaucratic, non–customer-focused attitudes prevalent throughout the organizational



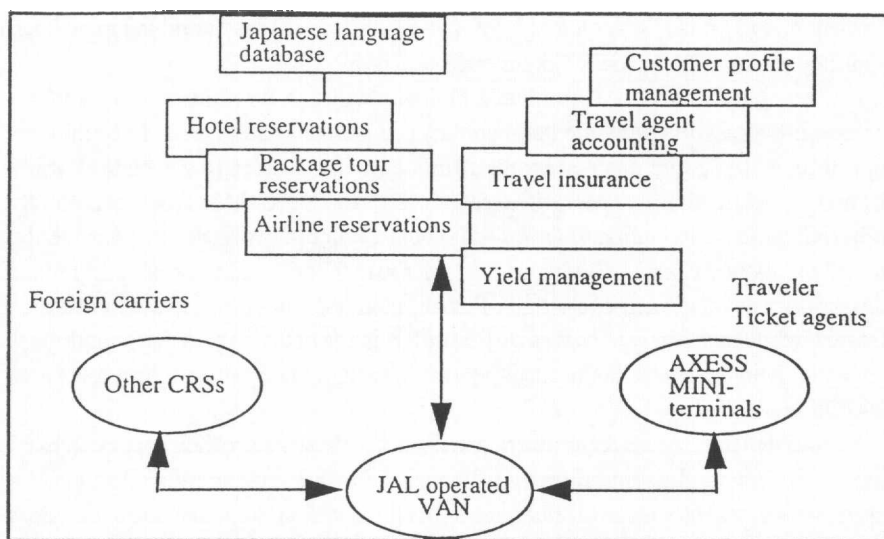


Figure 3. AXESS CRS Functions for JAL's Value Chains

hierarchy. Faced with new business challenges, top management supported the application of *quality circle (QC)/total quality management (TQM)* [14] in order to change the employee attitudes, particularly among middle-level managers. This was seen as a critical success factor for JAL to become more "customer-oriented." All employees were required to participate in various QC activities, and the impact of these activities on employee attitudes and service improvement was published in internal newsletters. TQM staff regularly surveyed Japanese travelers, analyzed questionnaire data, and provided QC groups with customer reactions to JAL service, including telephone operators, JAL reservations, airport ticketing, cabin service, and baggage handling. As part of TQM efforts to expand a rich source of data, JAL implemented a specialized customer call-in line, "Hello Line," to monitor customer reaction directly. The customer reaction trend was continuously fed back to all QC groups.

Although the nature of the change JAL has achieved was radical and focused on business process, the managers at JAL in general did not label their activities leading to this radical change *business process reengineering (BPR)*. Nor, however, did they consider their activities as those aiming at *kaizen* or an equivalent of Toyota's "continuous improvement." In light of the assertion in the literature that some firms in both the United States and Japan have undertaken process change activities similar to BPR well before 1990 [40, 62], when Hammer's *Harvard Business Review* article [21] made the concept of BPR more widely known to American managers, it is interesting to compare JAL's strategic change with the characteristics of BPR and to ask if JAL was an early practitioner of business process reengineering.

The key underlying assumptions found in the literature on BPR are: (1) it results in radical change; (2) it obliterates; (3) it focuses on business process; (4) it is top-down—

directed; and (5) it is IT-enabled [21, 22, 23, 62]. These five assumptions have been examined against JAL's "BPR" experience.

First, reengineering at JAL produced radical change in both intra- and interfirm business processes, but implementation proceeded incrementally. Second, reengineering efforts at JAL were enabled by the firm's core capabilities (e.g., human capital resources), while these capabilities realistically precluded JAL from completely obliterating. Third, reengineering at JAL focused on core processes to improve the quality of customer service, increase customer satisfaction, reduce cost, and reduce new product development cycle time. Fourth, reengineering *design* was top-down-directed, while *implementation* was carried out from the bottom up by JAL employees who actively interacted with the customer. Fifth, reengineering of *interfirm* processes was IOS-enabled.

JAL initiated the process reengineering activities to "restructure their core business." Hence, JAL's reengineering directly followed the firm's strategic vision to *build a leaner, more responsive, and more customer-oriented airline*. It was undertaken shortly after the firm radically restructured its organizational structure and downsized, particularly by reducing administrative staff and outsourcing noncore functions. It was perceived initially as a large-scale cross-functional cost-cutting initiative and later, when IOS was more fully implemented, as a strategic measure to radically change the ways in which JAL and their strategic value chain firms transfer information and knowledge, hence accelerating joint problem solving and new product development cycle time.

The IOS-enabled interfirm business process change powerfully facilitated the ways in which JAL and the networked firms shared proprietary information to create new knowledge and capabilities that are particularly critical in innovation. The literature on organizational learning has grown rapidly in the 1990s [35, 43]. Huber [26] and a number of others classify organizational learning into four processes: knowledge acquisition, information distribution, information interpretation, and organizational memory. The IOS discussed earlier in this paper supported these processes, except information interpretation. JAL's IOS integration with other strategic systems made knowledge acquisition and information distribution faster and more efficient within the networked firms. Once digital forms of information are created and made available by a given firm, any of the authorized networked firms can access it in real time as often as they need to. This reduced time-lag related to interfirm transfer of information and knowledge. This faster and more efficient information exchange within the networked firms enabled both JAL and their value chain firms to understand customer response quickly and to jointly reduce new product development cycle time.

## Discussion

THE CENTRAL INSIGHT FROM THE CASE ANALYSIS IS HOW JAL transformed its physical value chain into a virtual value chain and its impact on JAL's business growth and increased competitiveness as a consequence of improvements in its business processes. The two IOS initiatives discussed in this paper, CRS and EDI, were developed

with a clear strategic vision to support JAL in meeting the business challenges. To achieve this, IOS needed to become centrally embedded in JAL's core interfirm business processes.

As JAL's interfirm business processes became more efficient and effective, they initially affected JAL's business growth and competitiveness by speeding up customer response time. Over time, as IOS became more fully integrated with internal IT at both the JAL site and its value chain firm sites, JAL learned new capabilities by which it shared proprietary and strategic information and knowledge with the virtual value chain partners. This was particularly effective with respect to joint new product development. In this area, JAL's exploitation of the virtual value chain resulted in accelerated new product development cycle time. This further increased JAL's competitiveness in the intensely time-based competitive domestic and global markets.

In this last section, we first describe the salient characteristics of JAL's IOS-enabled virtual value chain compared with the traditional physical value chains. We then discuss JAL's major business outcomes: business growth and increased competitiveness. The latter was achieved in two stages. Initially, IOS speeded up customer response times. This was followed by improvements in new product development cycle times. This was facilitated by the new virtual value chain (business process change).

### JAL's IOS-Enabled Virtual Value Chain

The IOS-enabled transformation of JAL's "physical" value chain resulted in a "virtual" value chain. Particularly with respect to joint new product development, this virtual value chain provided new capabilities with which the focal firm formed strategic partnerships with its networked value chain firm(s) to exploit their complementary knowledge and capabilities. We have referred to the transformed physical value chains as "virtual value chains" to emphasize the flexible direction of information and knowledge flows across the network members.

Because the speed and flexibility of information and knowledge transfer are integral for joint product innovation, the IOS embeddedness is central to the transformation of JAL's value chains. Such embeddedness requires the active commitment and collaboration of network members, rather than mere compliance. Without such commitment and collaboration, members would not have accepted the importance of sharing information and knowledge reciprocally across the network partners. This acceptance was fostered by JAL successfully promoting IOS adoption without using its market power.

Virtual value chains differ from physical value chains in four important ways. First, the formation of strategic partnerships is not based on contracts or organizational forms. Instead, the strategic partnerships are information-based: The firm seeking information simply chooses as a partner someone who holds information it needs. Second, strategic partnerships are essentially temporary task groups formed to pursue a specific joint project (e.g., product innovation). Third, unlike other organizational structures such as strategic alliances or joint ventures, strategic partnerships between

the networked firms invest in relationship-specific assets, most notably in common network platforms and software applications (“physical capital resources”). Fourth, their valuable outputs are often intangible assets such as new knowledge.

Consider the domain of product innovation. In this industry, product innovation is very information-intensive [11, 13, 66] and time to market is a critical dimension. Firms that reduce new product development cycle time to market have a major competitive advantage [8, 61]. When JAL decided to draw on its networked value chain firms’ capabilities to accelerate innovative product development cycle time, the IOS system integration with internal IT by both the focal firm and the value chain firms was a key enabler. This integration supported the networked firms’ exchanging innovation-related proprietary information and knowledge more efficiently and flexibly than the traditional ways in which JAL had communicated with its suppliers.

While the new virtual value chain enables cooperation, not all product development will be done on the network. In his theoretical work on innovation-related sticky information, Von Hippel [66, p. 430] has defined stickiness of information as “the incremental expenditure required to transfer that unit of information to a specified locus in a form usable by a given information seeker.” Sticky information transfer cost is high, especially across the traditional firm boundary. When information held by JAL is sticky (e.g., costs of information transfer from JAL to a value chain firm are high), JAL engages in in-house innovative product development (e.g., JAL mileage program). In contrast, when information held by JAL is not sticky and costs of coordinating joint development with its value chain firms are not high vis-à-vis the costs of in-house development, JAL coordinates with the value chain firms (e.g., hotel management and ground transportation) to leverage their core capabilities in jointly developing innovative programs (e.g., new fly and stay tour package).

Essentially, the issue is one of tradeoffs between the cost of coordination and the benefits of synergy. We can develop this argument more formally. In discussing the role of virtual firms in innovation, Chesbrough and Teece [11] assume that virtual firms coordinate business processes (e.g., design, manufacturing, market, and distribution) through market forces (e.g., outsourcing), while fully integrated firms coordinate much of their business through the power of hierarchy. Costs of coordination are higher for these virtual firms. On the other hand, virtual firms have greater incentives to take innovation risks than do fully integrated firms. In other words, there are tradeoffs between innovation risk taking and coordination cost. The costs of coordinating JAL’s networked value chains fall somewhere between hierarchies and markets primarily because IOS reduced the costs of information transfer while increasing coordination efficiency. Our definition of JAL’s networked value chains as neither hierarchy nor market is consistent with the economic literature [16, 52, 53, 64].

As the above shows, the change in JAL’s value chain was a radical transformation rather than an incremental improvement. The radical nature of this change is readily apparent if we compare the key characteristics of the old physical value chain with those of the new virtual value chain. These are presented in Table 2.

First, like the traditional Japanese value chains [18], JAL’s physical value chains simply optimized business within the focal firm. In contrast, the virtual value chain

Table 2. Transformation of JAL's Value Chains

Characteristics	Physical value chain	Virtual value chain
Optimization	Within the focal firm	Across the value chain
Structure	Centralized	Networked
Mechanism for new value creation	Keiretsu structure-based	Knowledge-based
Direction of information/knowledge flows	Linear & controlled by the focal firm	Nonlinear & controlled by the information seeker
Value chain coordination	IOS minimal role	IOS central role

optimizes business across the networked value chain firms, particularly the JAL Group firms. Second, structurally, the physical value chain was centrally organized with the focal firm at the center of the structure. In contrast, in the virtual value chain, JAL is a node, albeit a very important node, in the network and does not necessarily occupy a central position. Third, the mechanism for creating new value in the physical value chain was dependent on JAL's keiretsu structure. Basically, product innovation relied on JAL's central initiative for generating ideas but JAL used its keiretsu structural relationships for gathering innovation-related information from its keiretsu member firms. In contrast, the virtual value chain is knowledge-based. Here the hierarchical structure of the keiretsu did not play a central role in product innovation, but, instead, any node firm in the network can actively occupy a central position. This is helped by the speed and the flexibility of flows of information and knowledge in the IOS network. Fourth, the direction of information and knowledge flows in the physical value chain was linear between the focal firm and a value chain firm, and the flows were primarily controlled by JAL. In the case of the virtual value chain, the flow of information is nonlinear, in that all networked firms access and use digital information many times once it is created. The flows are controlled by the information seeker. This explains the reduction of time lag in the transfer of information and knowledge across the networked firms collaborating in joint product innovation, and hence reduced cycle time. Finally, while the role of IOS in the physical value chain coordination was minimal, IOS plays a central role in virtual value chain coordination. Because of the increased speed and flexibility in information and knowledge transfer, coordination is now much more efficient.

### Business Outcomes

Although it is difficult to isolate and assess the impact of JAL's IOS-enabled transformed value chain on business outcomes, cross-validation of multiple data sources (e.g., the perceptive data from the managers interviewed and the articles on new product introduction in the secondary data sources) suggests that JAL's exploitation of the virtual value chain enabled business growth and improved competitiveness.

### Business Growth

The organizational transformations have been very successful and have helped make JAL the third-largest airline in the world, despite intense competition in global markets and the weakened Japanese economy. Table 3 compares JAL's business operations in 1995 with 1987, the year the firm was privatized. Despite increasingly strong competition in the international and domestic markets, JAL's core business, passenger air transport, has grown. The number of domestic passengers JAL carried, approximately 19.4 million in 1995, shows a significant increase of 106.7 percent from 9.37 million in 1987.

Similarly, the revenue from domestic and international passengers carried increased to 10.87 million in 1995, an increase of 76.2 percent from 6.17 million in 1987. As a result, JAL registered a substantial profit increase of 35.1 percent in 1995 over 1987. As of 1994, JAL has become the world's third-largest airline behind two U.S. carriers, based on revenues [17].

In part this improvement was an increase in JAL's domestic revenue passenger-load factor. Revenue passenger-load factor is a measure of operating efficiency used in the airline industry. It shows, on average, how efficiently the company manages "yields" from its available airline seats. In other words, it shows how full or empty the company's aircraft tend to fly on scheduled domestic or international routes. Domestic revenue passenger-load factor shows that JAL increased operating efficiency 3.8 percent in 1995 over 1987 on its domestic routes. This business outcome shows a significant improvement since the deregulation of the domestic market intensified the competition among the three largest air carriers in Japan. In contrast, international revenue passenger-load factor shows that JAL maintained approximately the same level of operating efficiency on its international routes over the period. This business outcome is also significant, given the intensified competition from foreign carriers including the two U.S. airline companies that earlier leveraged CRS.

While it is unlikely that the impact of IOS on JAL's key business processes was the sole cause of JAL's business growth and improved competitiveness, the consensus among JAL managers is that IOS played a major enabling role in realizing the strategic vision. This general consensus is consistent with the assessment of Yamaji, then president: "AXESS has already had an immense impact on our operations in Japan and overseas."

Furthermore, it should be noted that JAL's growth and improved competitiveness were realized in a hostile environment fostered by: (1) growing competition in both domestic and international markets primarily due to the deregulation of the airline industry in Japan and worldwide, and (2) the weakening Japanese economy. It is reasonable to conclude that IOS contributed significantly to JAL's business growth and increased competitiveness in two important ways. First, JAL's new IOS critically enabled the more efficient ways in which JAL's networked value chains contributed to the firm's core business (e.g., fuel purchase and airline ticket sales). Second, JAL's new IOS significantly transformed the speed and communication patterns by which JAL and its value chain firms shared information and knowledge.

Table 3. Business Growth

Measures of business growth	1987	1995	Change (%)
Operating revenues—passenger	564,052	789,786	35.1
Number of passengers carried—domestic	9,379,012	19,365,867	106.7
Number of passengers carried—international	6,170,107	10,869,218	76.2
Revenue passenger-load factor—domestic	58.2%	60.4%	3.8
Revenue passenger-load factor—international	70.9%	70.5%	-0.6

### Increased Competitiveness

While sharing many of the characteristics of BPR, JAL's transformation of the strategically important value chains took place *incrementally* over time. The initial focus was on efficiency. The focus then shifted to value creation through information-based strategic collaboration (e.g., innovation). Furthermore, while design of radical change was top down at JAL, implementation was carried out incrementally from the bottom up. This contradicts the accepted tenet of the BPR literature [21, 22, 23], but is consistent with results in the study of IT-based radical organizational transformation among Australian firms [57].

JAL's increased competitiveness developed *incrementally* over time in two stages: accelerated response time at the initial stage from exploiting IOS, and cycle time reduction at the later stage from leveraging the virtual value chain. In other words, JAL's increased competitiveness was initially IOS-enabled and later further facilitated by IOS-enabled business process change. We focus here on accelerated response time and accelerated cycle time as two major indicators of JAL's increased competitiveness.

### Accelerated Response Time

In discussing JAL's global environment in the 1980s, we have noted that the deregulation of the U.S. airline industry in 1978 led to increasingly intense time-based competition [38], and the diffusion of CRS made the airline industry around the world very information-intensive [12, 41, 45]. We have further noted, in our discussion of JAL's use of management methodologies, that TQM radically shifted JAL's employees' and managers' attitudes toward customer focus.

In this time-based competitive industry, initially JAL used IOS to speed up its customer response time. This was achieved through IOS, which improved value chain logistics coordination efficiency and reduced operating costs. This strategic use of IOS to improve the value chain logistics coordination efficiency speeded up JAL's customer response time. This was clearly visible with respect to airline seat reservation and ticket sales. AXESS CRS effectively reduced airline ticket processing time from

fifteen minutes to five seconds. As JAL's competitiveness improved, particularly with respect to its accelerated response time to customer airline seat reservation and ticket sales, a 35.1 percent increase in operating revenues from passenger transport from 1987 to 1995 was achieved.

### Accelerated Cycle Time

While JAL initially used IOS to speed up its customer response time, it later used the IOS-enabled virtual value chain to reduce its joint product innovation cycle time. This reduced cycle time was achieved because the key features of the new virtual value chain enabled both the focal firm and the network members to access and share innovation-related proprietary or strategic information and knowledge faster and more flexibly across the network. Improvements in the speed and flexibility of information and knowledge transfer among the networked members greatly reduced the time lag typically associated with interfirm transfer of information and knowledge. This further improved JAL's competitiveness with respect to product innovation cycle time under time-based competition.

### Conclusions

THIS PAPER STARTED WITH A GENERIC FRAMEWORK FOR ANALYZING IT-enabled business process change and applied it to the specific case analysis of Japan Airlines. In so doing, we have taken a longitudinal perspective and followed JAL from the global environmental changes leading to the deregulation of the Japanese airline industry in 1985, to JAL's privatization in 1986, and to the dramatic business expansion in 1994. Within this broad framework, we have focused the case analysis on the IOS-enabled transformation of interfirm business processes necessary to cope with the new business challenges.

The central issue is the impact of IOS-enabled virtual value chain on business process outcomes. The primary insight from the case analysis is that IOS enabled JAL to transform its physical value chain into a virtual value chain. JAL's new capability to exploit this virtual value chain has provided an engine of business growth and a new source of increased competitiveness. JAL achieved business growth and increased competitiveness despite both intensive competition in both domestic and international markets since the 1980s and the weakened economic conditions in Japan during the early 1990s.

In contrast to most case studies, the focus is on JAL's strategic use of IOS, particularly AXESS CRS and EDI, developed with a clear strategic intention to support JAL's emerging strategies on customer service, sales, value chain logistics coordination, and cost reduction. JAL's IOS-enabled transformation of interfirm business processes took place incrementally over time. The initial focus was on efficiency. The focus was later shifted to value creation through information-based virtual value chain partnerships for joint product innovation. This virtual value chain underpins JAL's (1) business growth in part due to improved customer service,



improved value chain logistics coordination and increased sales, and (2) increased competitiveness, particularly with respect to accelerated response time and accelerated product innovation cycle time.

One of the key findings is the impact of IOS on the transformation of the traditional top-down, hierarchical, keiretsu-based collaboration. This type of collaboration is based on the keiretsu organizational form with the focal firm at its center. While this lacks flexibility, it has been the basis of competitive advantage for Japanese industries [50] because it is governed by mutual trust. However, even though this type of collaboration was effective in the past, today, in a time-based competitive world, it is not enough to rely exclusively on that organizational form of collaboration. Instead, keiretsu-based interfirm collaboration has to be augmented with IOS-enabled virtual value chains to facilitate flexible, nonhierarchical communication across the network members.

Wider managerial implications of the study may be identified as follows: IOS can potentially play a significant role in radically changing both the speed and the flexibility of the ways in which the focal firm and its IOS networked value chain firms exchange sticky proprietary and/or strategic information and knowledge particularly with respect to joint product innovation. For many firms operating in a time-based competitive environment, the IOS-enabled product innovation cycle a time reduction provides a new source of competitive advantage.

It must be noted that, for academic researchers and managers concerned with isolating IT's impact on business processes, one difficult challenge is to understand and manage the complexity of large firms that may be applying more than one new management methodology concurrently in the pursuit of competitive advantage. We acknowledge this complexity and have examined how IOS may be exploited in conjunction with management methodologies such as TQM, BPR, and organizational learning to improve business processes.

## NOTE

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1. In Greek mythology, Icarus created wings out of wax and attempted to fly to the sun, but the heat of the sun melted the wax and he fell into the sea. The message is the same as in the biblical story of the tower of Babel.

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