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Research Report

The Promise of Information Technology in the Travel Industry

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Abstract

Two words best characterize the future for the travel industry: growth and change. Many global forces have driven companies in this industry to adapt quickly to survive and remain competitive. Information technology plays a vital role in the way the travel industry responds as the world is "getting connected" at almost every level. The purpose of this paper is three-fold. First, the effect of network computing, the combination of electronic ticketing and smart cards, corporate travel management systems, and other trends that are transforming the travel industry will be examined. Second, the public policy issues involved such as the liberalization of government regulations, affordability and ease-of-use, and data security and privacy will be examined. Finally, the future direction of underlying technologies such as displays, storage, and microprocessors and advancements in the global networking infrastructure, mobility, and speech recognition will be presented.

Keywords: Corporate travel management, data mining, displays, electronic ticketing, information technology, kiosks, microprocessors, mobility, network computing, smart cards, speech recognition, storage, travel.

1 Introduction

Two words best characterize the future for the travel industry ... growth and change. The World Travel and Tourism Council have estimated the gross output of travel and tourism at $3.4 trillion in 1995. By 2005, this figure is expected to more than double to $7.2 trillion. Consumer expenditures, the largest piece of the industry, were $1.9 trillion in 1995 growing to $3.9 trillion in 2005. In this same period, capital investment is expected to grow by nearly 70% and business travel will grow 54%.

Many global forces have driven companies in this industry to adapt and change quickly to survive and remain competitive. For example,

- There is a massive shift from business to leisure travel as frequent, short breaks become the norm and as middle income wealth is created in emerging economies;
- Capacity is being rapidly added, particularly in Asia, where, over the next decade, it will climb from 34% of all international travel to over 50%;
- Competitive differentiation is a key issue to avoid commodity-like status. Hence, continuous improvement to raise product and service quality is important;
- Insightful and creative approaches to market segmentation and loyalty management are being used to improve load factors and occupancy rates;
- Continuing price and margin pressures are driving programs to reduce cost while improving productivity and asset utilization;
- And, more fundamentally, the competitive battlefield is changing with industry consolidation, global alliances, de-regulation, private ownership, and rapidly emerging electronic distribution channels.

Information technology will play a vital role in the way the travel industry responds to these global forces. Total spending on information technology will reach $1.3 trillion by the year 2000 according to the Gartner Group -- a 16% compound annual growth rate in information technology spending. The travel industry is spending approximately $20 billion per year on information technology today.

The massive changes in the travel industry raise numerous questions for both the customer and the industry. For example, if customers can use the Internet to make and pay for reservations directly, what happens to the traditional role of the travel agent as the intermediary? If kiosks, voice recognition units and smart cards become the norm for airport, rental car, and hotel check-in processes, how do service providers quantify and plan for proposed changes to achieve lower costs, better utilization and gains in customer loyalty?

The purpose of this paper is three-fold. First, the effect of these and other trends that are transforming the travel industry will be examined. Second, the public policy issues involved will be examined. Finally, future directions of the underlying technologies will be presented.

2 Information Technology Transforms the Travel Industry

The travel industry has been exploiting information technology products for more than 30 years. While the travel industry is already an intensive user of information technology for reservation, accounting and inventory management functions, information technology is becoming even more important in helping companies survive and grow as costs and service expectations rise, cycle times compress, and market share becomes harder to maintain. Information technology plays an essential role in lowering the cost of business processes, such as inventory management, scheduling, pricing, and customer service. Global scale and scope, seen by many as the key to survival, can only be managed with real-time information and constant communications. Information technology is central to any new distribution approach, especially those going directly to leisure customers and those providing travel management processes to corporations. Information technology can also differentiate between products, for example self-service check-in, trackable freight, or inflight seat-back systems. The point is that the use of information technology is moving from the "back office" to the face of the consumer and that novel uses of information technology become a competitive advantage.

Increased demands for information technology will come in the following areas:

- Reengineering of legacy systems which are obstacles to change;
- Best-of-breed, open industry applications for both operational efficiency and revenue generation;
- Network computing applications to supplement existing distribution channels and enable global alliances;
- Outsourcing services as companies return to core competencies and seek to gain operational savings.

The technology is available today to affect fundamental change in the travel industry. Three applications that will revolutionize the travel industry are described here: network computing, the combination of electronic ticketing and smart cards, and corporate travel management systems.

First and foremost, the move to network computing, where applications and data reside in the network, represents a powerful computing evolution. Network computing allows: companies to connect to their customers, suppliers, and business partners; individuals at work, home, or school to share information over interconnected networks; and businesses, governments, and educational institutions to reach new markets, offer new services, and lower costs. There are now 40 million people connected to the Internet. The number is doubling every nine months and is expected to reach between 400 and 800 million in the year 2000 when there will be over 1 million networks and 100 million connected computers.

A WebCrawler search on "travel" now produces over 60,000 hits, up from only 5,000 in August 1995. One industry analyst, Julius Maldutis of Salomon Brothers, has predicted that the airlines' growing use of the Internet will produce the third

revolutionary change in the industry, comparable to the impact of jet aircraft in the late 1950s and airline deregulation in 1978.

Greg Conley, IBM's General Manager for Travel and Transportation, states that "travel distribution is the industry that invented electronic commerce and network computing over two decades ago." He believes that travel distributors need to be at the cutting edge and forefront to drive network computing to be a more broad-based model. For example, hotel and car rental companies should aggressively embrace the Internet to reach new customers, to give existing customers what they demand, and to lower costs. Furthermore, providers of customer reservation systems (CRS) and global distribution systems (GDS), being in the transaction processing business, should aggressively embrace the Internet as an additional source of income. Lastly, travel agents should also aggressively embrace the Internet to reduce costs and increase productivity. Examples of increased productivity include moving the booking process to the consumer, advertising specials worldwide to gain new customers, developing a database of information on customers to understand their buying patterns and preferences, eliminating the need to stock and distribute brochures which can now be accessed on-line, on CD-ROM, or via self-service kiosks, and finally, establishing links to other web sites in which your customers are interested. This last example could be extended to web agents that create "on the fly" links to other web sites by observing a user's patterns of access to aid the Internet search process.

The second technology that will revolutionize the travel industry is the combination of electronic ticketing and smart cards. This combination will eliminate a large percentage of the cost from travel distribution through on-line settlement, revenue accounting, and the elimination of physical ticket handling or ticket delivery. Airlines, hotel chains, and rail companies across the world are evaluating ways in which smart cards can help them to provide a more competitive service to their key customers -- the frequent flyers, repeat hotel guests, and regular rail passengers who travel mainly for business reasons. With 20% of air passengers responsible for 60% of the journeys, airlines are keen to build on their existing frequent flyer relationships.

Worldwide, some 760 million smart cards were issued in 1994, and the number is expected to grow to 2.5 billion in the year 2000. France has pioneered smart cards as telephone cards, and Lufthansa has used smart cards for frequent fliers on German domestic routes. The potential for the travel industry is significant. For instance, a single smart card carried by a customer could serve as:

- Reliable identification for fast, ticketless travel and for instant, kiosk-operated hotel registration and check-out;
- Reliable identification for immigration and customs;
- An updatable database of the traveler's preferences for seat location, accommodation, catering and amenities;
- A medium for implementing incentive and reward schemes;
- An electronic purse for pre-boarding, on-board, or in-hotel purchases;
- A co-branded link to a payment firm (e.g., credit card, debit card, or travel and entertainment charge card);

- A link to a travel business partner (e.g., a car rental company);
- An automatic, electronic record of the traveler's itinerary and expenses;
- A key to making secure payments for Internet bookings.

In October 1996, American Express and IBM announced plans to pilot a multi-purpose corporate smart card. Initially, these smart cards will be tested with American Airlines' enhanced gate readers, which are now installed in 21 U.S. airports, for ticketless travel.

At Southwest Airlines, which became the first major carrier to use ticketless travel systemwide in January, 1995, officials have estimated that the innovation saved the company $25 million last year. Beyond that, in the first two years of the program, the airline has gone from selling 40 percent of its tickets directly to consumers to 60 percent, with large savings in commissions to travel agents. In the Los Angeles Times' October 27, 1996 issue, the following North American carriers were described as deploying electronic ticketing in some form or another: Alaska Airlines, American Airlines, Continental Airlines, Delta Airlines, Northwest Airlines, TWA, United Airlines, and USAir. Clearly, this is a technology that airlines are embracing.

As soon as there is an accepted and published resolution from IATA/ATA on standards for electronic ticketing and smart cards, airlines will commit to the wide deployment of smart card systems. Installation of check-in kiosks and the integration of card readers with existing systems will be a key implementation step.

Self-service kiosks can dramatically reshape the relationship between the service provider and the customer by providing "direct customer access." Available kiosk solutions include: airline reservations and ticketing, airport check-in, seat assignment and changes, issue of boarding passes, receipt printing in a ticketless environment, arrival and departure information, loyalty program administration, passport documentation check, hotel room reservations and selection, concierge services, rental car reservations, casino coupon and complimentary redemptions, casino player card issuance, electronic shopping, and gathering customer feedback. Specific examples include Promus Hotels piloting a versatile kiosk system that provides all the information relevant to a guest's stay and Harrah's Casino Hotel in Atlantic City introducing Quick Comp multimedia kiosks as part of their strategy for improving customer loyalty.

The third area where information technology will have a profound impact on the travel industry is in corporate travel management. Total corporate travel management will expand from booking reservations to expense reporting and disbursement. Corporations will look to travel managers for ways to control escalating costs and expenses. Travel agents will become more differentiated, specializing in specific travel offerings, for example African safaris, and will extend their capabilities to other value-added services such as arranging to stop the mail, pick up the dry cleaning, walk the dog, and so on.

American Express, Apollo Travel Services, Carlson Wagonlit Travel, Nationwide Insurance, Rosenbluth International, SABRE and United Airlines are a few of the long list of suppliers and travel agencies racing to develop a comprehensive, all-in-one product that automates the book, pre- and post-approval, and expense reporting processes. Most of the products currently available are off-line resulting in a delay from when the traveler makes a request for travel information and when it is received.

SABRE's Business Travel Solutions (BTS), which is currently in beta test, is distinct in that it offers real-time access to SABRE. A booking module with real-time access to SABRE offers airline, car rental, and hotel reservation options based on the corporation's travel policy and preferred supplier program. An expense reporting module can automatically match a traveler's completed expense form to the corporate policy before it is sent through for approval to identify any errors, expenses that may require receipts or those that exceed what is allowed in the policy.

Internet Travel Network, a leading provider of on-line travel reservation services via the world wide web, announced in August, 1996 the debut of Internet Travel Manager, a full-service Internet travel booking and management product. The Internet Travel Manager is the first service deploying commerical Internet purchasing technology into a corporate intranet environment to support travel booking by employees.

3 Public Policy Issues

One of the drivers of growth and development in the travel industry has been the liberalization of government policies which encourage open competition. "Open skies," and policies which are resistant to regulation, government monopoly, subsidy, and other barriers to trade have reshaped the industry. For example, eleven European govements have signed "open skies" agreements with the United States as a prelude to new alignments. As a result, United entered into an alliance with Lufthansa, Northwest with KLM, and Delta with Sabena, Swissair and Austrian Airlines. Pending in 1996 is a marketing alliance between British Airways and American Airlines.

Affordability and ease-of-use are increasingly important. To date, despite much progress, estimates are that only 1% of the world's population uses on-line services or the Internet to arrange business travel. According to USA Today, this number is expected to increase to 20-30% in Europe within several years and number 30 million users worldwide by the year 2000. Keys to the adoption of these services are electronic ticketing, smart cards, improved Internet search facilities, and other user-friendly, front-end reservation applications.

Data security and privacy are pressing issues for travel, as for most other industries. As corporations move more of their business to the Internet and more private networks, called intranets, are linked to the Internet, the need for secure communications, backup, and disaster recovery will grow. These issues are not unique to the travel industry, but they do have special implications where the

individual privacy of the traveler is involved, where distribution channels might be disrupted, or where mission-critical deliveries are involved.

Public key cryptography is a technology that is becoming very widely used and extremely important in a wide variety of areas. It is both different from the older secret key, or symmetric cryptography, and is complementary to it. In secret key, both the sender and recipient share the same secret key and use the key to encrypt or decrypt messages. This leads to the problem of how to share the secret key securely.

Public key cryptography solves this problem and also adds some very important features secret key cryptography doesn't handle including:

- *Authentication.* Using public key cryptography, a message recipient can authenticate that the message was created by a specific person and was not forged or created by an impostor.
- *Integrity.* Using public key cryptography, a message recipient can determine that the message was not changed or corrupted in any way since it was created by the originator.
- *Nonrepudiation.* Using public key cryptography, a message recipient can prove that a message was definitely created by the originator even if the originator "repudiates" the message, claiming that someone else created the message using their name.
- *Privacy.* Privacy is best provided by the well-established symmetric cryptography systems and algorithms, however public key cryptography makes the key transmission, sharing, and management much simpler and more secure, and thus a combined public/shared cryptographic system is now widely used to provide privacy.

4 Future Directions in Technology

This section describes the future direction of underlying technologies such as displays, storage, and microprocessors and advancements in the global network infrastructure, mobility, and speech recognition. Implications are given for the impact to travel.

4.1 Displays

Display technology is moving very quickly and will drive several new classes of applications over the next decade. First, flat panel displays will surpass the cathode ray tube (CRT) in image quality and approximate or even exceed the image quality of paper. This advancement will open up new uses such as reading complex documents, viewing high quality images, studying detailed diagrams and graphics, and exchanging lengthy communications.

The second major class of applications involves the new ability to miniaturize displays and make novel and ultra-portable devices. Display chips result from the marriage of silicon integrated circuit technology and some form of optical transducer (e.g., liquid crystal cells, movable mirrors, or light emitting materials). When display chips are

combined with a suitable optical system, they can project images directly on the retina and give the visual appearance of a conventional-sized display. The display will no longer be the limiting factor in size reduction of personal clients.

The third set of new or expanded applications involves large screen displays for group viewing, or individual viewing, of very large amounts of information. The technologies will be based on display chips with projection optics and high brightness illumination sources, possibly including lasers, or on flat panel technologies like plasma which economically scale to large areas. These new display systems will be able to present large, detailed images and diagrams or multiple screens of information and video.

4.2 Storage

Storage devices such as hard disks, tape libraries, and optical disk libraries are on an evolutionary track that is well-established. For example, hard disks have improved by six orders of magnitude in areal density in the last forty years. In the next ten years, about 30X density improvement for hard disks is attainable. Magnetic storage will continue both its rapid advance in storage densities and its domination as a storage medium.

Optical storage in CD-ROM and digital video disk (DVD) technologies will have stable capacities, as consumers will not be willing to exchange their players and entertainment libraries on a rapid basis. In the next ten years, about 10X density improvement for optical storage and tape is attainable. Publishing using hypertext markup language (HTML) and DVD technology will become the new medium for disseminating large amounts of content.

4.3 Microprocessor Performance

Parallel and multiprocessor systems will become very important in the various server regimes. Low power microprocessors for personal digital assistants, controllers, and consumer devices will become both widespread and inexpensive.

4.4 Global Networking Infrastructure

The computer application environment is primarily TCP/IP-based, and direct ATM to the desktop is expected to only gradually encroach on this. As ATM in wide area networks is the better protocol for delivery of real-time and multimedia traffic, a heterogeneous network environment is ensured. Multimedia traffic will greatly increase, and cause degradation of network service, which will lead to novel caching solutions, and private toll roads for guaranteed levels of network service. The delivery of significant bandwidth to the home has several paths, including telephone systems (e.g., ISDN, ADSL), cable, and satellite. It is unclear which mode, if any, will become widespread and dominant, as the deployment depends on significant financial commitments in this turbulent arena.

4.5 Mobility

Mobile systems will continue to shrink in size and grow in power. A personal communicator is one example of a mobile system that combines a personal information manager with universal access and interaction using speech, pen, and graphics. An electronic book is another example. Early applications include maintenance repair manuals and parts manuals.

1995 was an excellent year for paging, which is evolving from one-way to two-way, and with increasing ties to computing and the Internet. The future will see smart cellular phones that offer some computer functions, but are primarily phones.

There are new devices for paging networks. A few carriers and resellers have introduced web sites that can be used to enter messages for transmission over paging networks. Several companies are developing new strategies to connect paging with electronic mail.

4.6 Speech

Continuous, large vocabulary, speaker independent speech recognition will be available by the year 2001. There will be a wide range of resource versus accuracy trade-offs, allowing deployment in a variety of systems and usage contexts. Speech synthesis will emerge as a strong, complementary technology. Together, both technologies will enable applications such as reliable automatic dictation, voice-mail acquisition, digital libraries (information retrieval), domain-specific control, home appliances management, and others.

Some of these advancements will be enabled by better recognition algorithms, larger vocabularies, and better training methods, but a significant part will be driven by advances in natural language processing (understanding and generation). Thus, "language aware" algorithms that support syntax and semantics, intonation, and articulation will be necessary to complement raw speech recognition and generation capabilities. Speech may also be used to authenticate travelers using 60 seconds of sampled speech. Other biometric advances include fingerprints and hand geometry.

4.7 Implications of Future Technology on Travel

The future directions for the role of information technology on travel include:

- Enhanced voice recognition to further simplify the reservation process;
- More powerful and easier-to-use Internet search engines;
- Internet tools that "mine" customer data to reverse the equation around, i.e., push offers to consumers instead of waiting for the consumer to ask "what is available at this time and at this price?"
- High quality videoconferencing capability at the individual work station;
- WebTV and network programming tools such as Java to expand the Internet customer base.

5 Summary

To summarize our view about tomorrow's landscape, the future of travel as enabled by information technology, we will make six predictions:

1. Travel Distribution Systems will evolve from GDS-dominated to truly interconnected networks.
2. Customer information systems will support highly personalized service as a basis for competitive advantage.
3. There will be a revolution on the revenue side of the business, with finer segmentation, better yield management, and expanded market reach.
4. Travel sales channels will undergo fundamental structural change, and disintermediation will create winners and losers.
5. Legacy systems and business processes will be radically redesigned to gain cost advantages.
6. Individual enterprises as well as entire industries will upgrade and connect their information technology instrastructures to support collaborative computing and electronic commerce.

Each organization must take great care to ensure that information technology plans are perfectly aligned with business strategy, information technology projects are carefully prioritized within the limits of available skills and resources, and performance measurements are in place to ensure adequate return on information technology investment.

To understand what all this means to the traveler, let's look at a future scenario.

The year is 1998 and identical twins Bill and Ted are about to celebrate their 40th birthday with a golf vacation in Bermuda. The logistics are complicated because their careers have led them in different directions. Bill lives in Vancouver, Canada, where he is vice president of a pharmaceutical company, and Ted lives in Melbourne, Australia, where he is a physician.

No problem. With collaborative computing, they can view airline schedules and travel brochures together, even though they are 8,000 miles apart, hunt for bargain fares and competitive hotel rates, and book their flights and rooms on-line. Smart cards pay their fares by debiting their bank accounts electronically through readers built into their personal computers. Their smart cards also contain a travel profile which tells the airlines their seat and meal preferences, and the customs and immigration officials their passport and other data -- no standing in line.

Problem: They're about to set off when a hurricane builds up in the Atlantic and their flights are canceled. Once again collaborative computing comes to the rescue. Using self-service kiosks at their respective airports, they agree to change their destination to Scotland and book new flights, rooms and rental cars.

In the air, Bill uses his computer to plan his next business trip through a corporate travel system which not only makes reservations but also keeps track of his business expenses. The system files his expense report and transfers the reimbursement to his bank account. It also ensures he is complying with his corporate travel policy and taking advantage of the company's preferred supplier agreements.

Ted checks his home security system, since his wife and son are also away on vacation, and finds the electronically controlled garage door is open. A simple keystroke closes the garage door.

One problem remains. Bill planned to surprise Ted with a custom-made set of golf clubs from a manufacturer in Arizona -- ordered and paid for through the Internet -- and now the clubs are on their way to Bermuda instead of Scotland. Bill plugs his PC into the communication port on his airline seatback, connects via the Internet to the supplier's freight management company, and tracks the clubs to a truck heading for Phoenix airport. The truck driver locates the clubs by means of the radio frequency identification tag affixed to the package and updates the tag to divert the clubs to Scotland.

Ted decides to relax on the flight from Australia to Scotland. The flight attendant gives him personalized customer service by bringing his favorite magazine and a bottle of fine French wine. His special meal is also on-board the plane. All this information was gathered from his smart card and from records the airline accessed in their database about frequent flyers. As Ted starts to unwind and relax, he decides to play video games and gamble on the in-flight system in the seat back.

Bill and Ted's smart cards contain all their passport information, which speeds them through customs and immigration in Scotland. They must do a hand scan for identification verification. Some airports have implemented biometrics where the hand scan identifies versus verifies the passenger; however, the Edinburgh airport has not yet migrated to this technology.

Bill's active smart card notifies the rental car company that he has passed through customs. The car is brought to the terminal. The rental car agency has run a decision support system to find the optimal route for Bill and Ted to take to the hotel. A bad accident has forced the authorities to close the major highway so Bill and Ted take the back country roads. The map, optimized route and directions are depicted on the on-board computer in their vehicle.

At the hotel in Scotland, they go straight to the check-in kiosk in the lobby and swipe their smart cards through the reader to get their room assignments and keys.

This is not just a fantasy of the future. Information technology is already making such ease-of-use and efficiency possible at lower cost, and end-users like Bill and Ted are the beneficiaries.

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