ERP 306-674

Group Assignment

Topic: Airline Industry Software Requirements

Prepared by:

Maged Eissa
Sandy Hofman Aruan
Thu Thuy Nguyen
Liu Yang

Faculty of Economics and Commerce
University of Melbourne
Australia
2005

TABLE OF CONTENT

Client Summary

Software Decision Consulting has been asked to undertake software requirement analysis for the Airline Industry Trade organisation (The Client) in regard appropriate software market segment identifications as well as the best suitable software vendor providers for the airline industry. The deployment of the appropriate system technology should enhance industry future growth potential, improved operating environment, collaboration and cost savings.

Based on the analysis presented in the following report, it has been recommended that The Client should consider the benefits from two specific software market segments, namely Customer Relationship Management (CRM) as well as Advanced Planning & Scheduling (APS). In addition, it is suggested that Siebel is the best suitable CRM vendor and Manugistics is the most suitable vendor in the case of APS implementations.

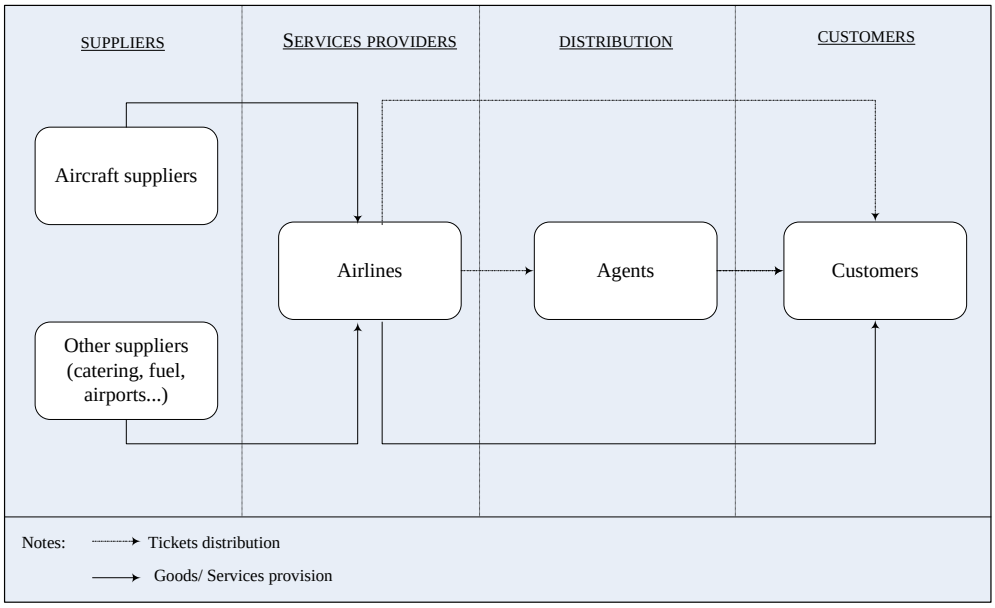
Full descriptions and justifications for these recommendations are detailed within the following document. The situation has been analysed using the latest information available to Software Decision Consulting and no responsibility is held for any potentially adverse events resulting from the client acting on this recommendation.

Introduction

This report's objective is to briefly describe the airline industry value chain, airline industry environment and the strategy of the firms operating across this value chain. In light of this overview, software market segments will be identified that would most probably add value to the improvement of the airline industry operating environment, productivity enhancement, collaboration, industry revenue generation and cost reductions. Due to changes in industry and market dynamics, airlines are required to change their business practices to better meet customer expectations as well as their interactions with their suppliers. This equation has to then be balanced in order for demand requirements to be better met by their fulfilling supply optimisation activities. The analysis of which software market segments will fulfil this objective are discussed in the second section of this report. Finally, the third section of this report will compare and contrast possible software vendors based on recommendations made in the second section. Recommendations will then be made with regards to which software vendors will most probably be suitable to implement the suggested systems that will enhance business activities through the deployment of advanced and up-to date technology.

SECTION ONE

Description of the airline industry supply chain



Suppliers

1. Aircraft manufacturers

There are two main giant aircraft manufacturers in the market, namely Boeing and Airbus. Boeing employs more than 159,000 with revenues in 2004 of $52.5 billion (Boeing, 2005). Airbus has 52,000 employees and revenues in 2004 of 20 billion euros (Airbus, 2005).

Boeing and Airbus produce and provide commercial aircraft for most airlines in the world. Aircrafts are provided under purchasing contracts or leasing contracts.
They also offer after sales services such as airplane maintenance, repair and overhaul facilities. These after sales services are major sources of revenue for the aircraft manufacturer firm (Grant, 2005). Airplane manufacturers have strong bargaining power because of their market domination and limited number of firms who have the capacity and the financial capability.

Demand for airplane travel decreased during 2001-2003 because of the fall in airline travel due to the negative impacts of the 11 September attacks. However, in 2004, the airline industry recovered (Boeing, 2005). Demand for new aircraft (to satisfy demand and replace the old ones) with estimated demand increase to 18,596 in the next 20 years (Boeing, 2005).

Strategy

Aircraft manufacturers aim to be more responsive to customers' needs. They focus on convenience for customer when using concept of aircraft families which lead to cost efficiency for airlines. Because of a global network, the strategy of having a multi-cultural environment company-wide where employees share different backgrounds and expertise is prevalent.

Challenges

Due to intensive market competition, the challenge of cutting costs across the whole supply chain while still maintaining acceptable profit margins prevails.

Another challenge to the aircraft providers in implementing their strategies is to ensure quick responsiveness to customers' demand. This requires close collaboration between aircraft manufacturers and airlines, especially for design activities (Sheehan, 2005).

2. Other suppliers

Catering suppliers, fuel providers, airport facility providers, maintenance providers all fit into this category. Airport facilities providers and airport regulators have control over some aircraft operations; i.e. they decide when an airplane takes off or lands. These firms have to face the main challenges of scheduling airline demand (planning for airplanes, taking off and landing). Airport providers therefore ask for airlines to proactively cooperate in providing them with accurate schedules in order for airport operators to appropriately plan their activities.

In addition, there are many catering and fuel suppliers in the market. They have low bargaining power in the airline industry because airlines can have numerous options in selecting vendors with regards to these inputs with relatively low switching costs. The main challenge for catering firms is to plan and schedule their inputs to airlines.

Airlines

Airlines play a central role in the industry supply chain where they provide transportation services to travellers. In addition to passenger transportation, airlines also earn revenues from cargo, frequent flyer services. But the largest proportion of revenue comes from passenger travel (Investopedia, 2005).

Different airline organisations are operating in the market and their sizes depend on three main categories (Investopedia, 2005).

- ***International:*** Companies have annual revenue of more than $ 1 billion and operate more than 130 seat planes that have the ability to take passengers just about anywhere in the world.
- ***National:*** companies have revenues between $100 million and $1 billion and operate airlines with 100-150 seats
- ***Regional:*** companies with revenues less than $100 million that focus on short-haul flights.

The airline industry is very competitive one in which the number of airlines increases due to deregulation and liberalisation policies that had occurred (i.e. in US, Australia) and is starting to occur in Asian countries as well. Consequently, it is very difficult for airlines to differentiate themselves to maintain customer loyalty and outperform rivals. Furthermore, high fixed costs prevent airlines from exiting the market.

After the September 11 attack, established airlines had to cope with unexpected decreases in demand during the years of 2001 to 2003. Many airlines were filing for bankruptcy (i.e. Swissair, Sabena, U.S airways, United Airline). In contrast, low cost airlines remained strong and achieved significant growth. Southwest Airlines (U.S), EasyJet (U.K) and AirAsia (Malaysia) are examples of successful budget airlines with increases in revenues and profits during this period (AT Kearney, 2002). This low-cost segment is predicted to have rapid growth opportunities in the future. After the airline industry recession, demand for air travel recovered in 2004 and is expected to smoothly increase over the next 20 years (Boeing, 2005).

Strategy

Airlines' corporate strategy aims to gain market share and operate internationally under the strategic alliance or joint ventures business models. With regards to operational activities, airlines adopt the customer focus strategy which incorporates customer needs and preferences into their decisions making process.

To successfully compete in the domestic and international market, airlines build up their differentiation strategy for the premier market and cost leadership for budget segment.

Challenges

In implementing the low cost strategy, airlines need to effectively manage their operation and maintenance activities within an economical budget. Operational efficiency is reflected through effective scheduling of flight crew and flight schedules. Effective maintenance requires spare part inventory control (inventory lifecycle and warehousing) to timely complete repairs. Furthermore, overhauling schedule is also very important in guaranteeing not only security but also the quality of services provided to customers.

Another challenge facing airlines is to well manage customer relationships in deploying customer focused as well as differentiation strategies. Good deployment of CRM in the airline industry initially requires customer segmentation and appropriate pricing policies for different customer categories. Then, demand has to be forecasted in order to be matched to supply activity planning. In forecasting demand, airlines have to take into consideration the seasonal effect of airline traffic.

Agents

Agents receive commission from airlines to sell their tickets. They operate as sellers of airline services. Marketing functions are usually controlled and implemented by airlines. Agents do not have pricing functions either.

Agents play an important role in interacting with customers and can help collecting customer transaction data. This data is useful in reporting and forecasting demand as well as developing pricing strategies. However, the deployment of advanced web-based services reduces customer interaction with agents.

Customers

It is estimated that in the next 20 years, annualized world GDP grow at 3.0% and customers demand for air travel will increase at an average annual rate of 5.2% (Boeing, 2005).

Airline demand are affected negatively by global factors including airline security such as the 9/11 attack and natural calamities (earthquakes, tsunami) or diseases (SARS, bird flu). Business travellers are much more price insensitive than leisure travellers and are more concerned with time and quality of service factors. Due to increased competition and more customer awareness, airlines will have to find new ways to interact with customers in order to retain, attract and keep existing customers. The focus of airlines, in particular, will have to shift from a product to a customer focused organisations that can respond quickly and flexibly to customer preferences and needs if they are to gain competitive advantage as well as their bottom line profitabilities.

SECTION TWO

Introduction

After the description of the airline industry value chain in the first section of this report, this section will explore and focus on two software market segments that would benefit the airline

industry. The recommended two software segments are Customer Relationship Management (CRM) and Advanced Planning & Scheduling (APS). These two software segments would be highly beneficial from an airline organisation's perspective as will be discussed. It is assumed that an ERP system is already in place.

Customer Relationship Management (CRM)

'A survey of 17 major airlines around the world reveals that even the most sophisticated among them have only a rudimentary understanding of who their most valuable customers are or could be, which factors affect the behaviour of these customers, and which CRM levers are most effective in ensuring loyalty' (Bingelli, Gupta, De Pommes, 2002). CRM has long been the keyword for airlines aspiring to build a 'one-to-one' relationship with all customers, which is a very challenging task in the commercial airline industry. 'Its underlying principles are well established too - those airlines that can effectively attract, serve and retain the best customers will see significant positive effects on their bottom line profitability' (Jiang, 2003). To define CRM, it is very important to notice that CRM is a process rather than just implementing technology. The process includes the changing of processes to satisfy business objectives, organisational change as well as proper deployment of technology where the customer becomes the centre of value-adding activities in the organisation and hence the organisation becomes customer centric. 'Simply stated, CRM comprises the acquisition and deployment of knowledge about customers to enable an airline to sell more of their product and service more efficiently' (Flagnan & Sadie, 1998). The key to this customer relationship is to satisfy the needs and preferences of each group of customers and provide them with a service experience that will in turn help the airline retain existing profitable or valuable customers and attract new ones by deploying the CRM approach. It is important to note again that re-assessing existing business processes especially those where interaction with customers is involved will drive the means of technology to use and not the other way around. In other words, the marketing and organisational strategy will drive the technology and will be key to success in the system implementation process.

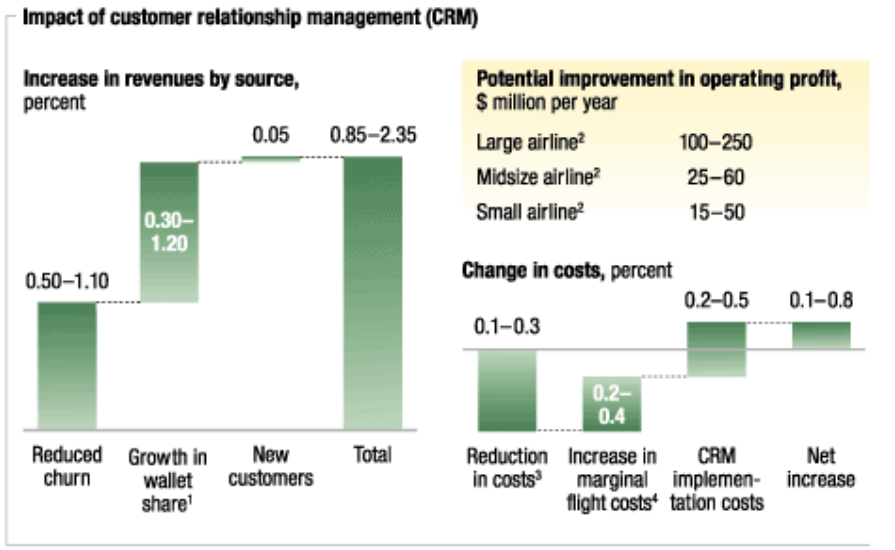
Why CRM matters

As competition between airlines in the airline industry intensifies, the only way to increase or maintain profitability is to attract new customers, maintain existing valuable ones or retain the most valuable customers for as long as possible at a low cost. Studies and research show that acquiring new customers will cost much more than retaining existing ones who will be loyal if their needs are satisfied and will hence consume or buy more frequently the services of an airline in the future. Thus, airlines should recognise that it is worth investing to maintain existing profitable and loyal customers in order to compete and increase the value of the organisation. CRM as a process is the way to achieve this objective.

In addition to the strategic importance of CRM in building an effective relationship with its customers, an airline can realise increases in revenues as well as significant decreases in costs, up to $250 million for large airlines, due to the more targeted and efficient CRM approach (Jiang, 2003). In order to assess the impact of CRM on the airline as well as how an airline can retain and attract valuable customers, see Exhibit 1&2 below.

EXHIBIT 1

Good for the bottom line

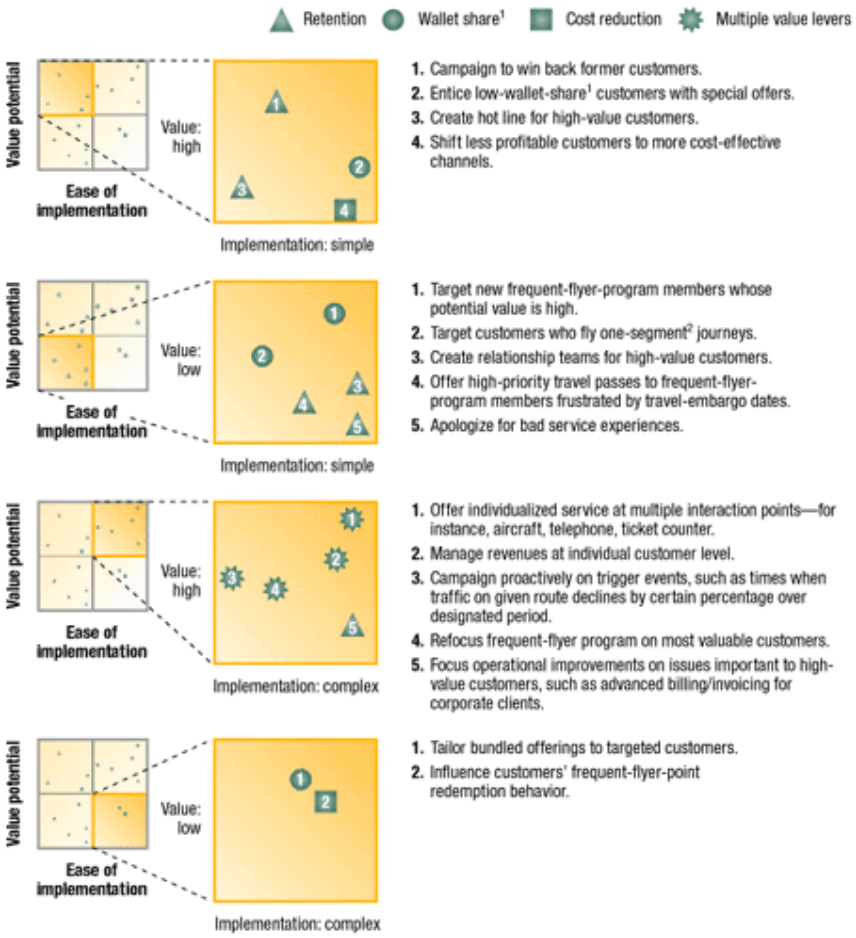


[1]Proportion of consumer's disposable income allotted to single company.
[2]Based on revenue-passenger-kilometers (RPKs), that is, number of passengers multiplied by number of kilometers they fly; large airline = 76 million to 200 million RPKs; midsize = 21 million to 75 million; small = 5 million to 20 million.
[3]Through elimination of waste associated with targeting unprofitable customers.
[4]Due to increased business.

Exhibit 1- Source: CRM in the air, 2002

EXHIBIT 2

What's an airline to do?



[1]Proportion of consumer's disposable income allotted to single company.
[2]For example, one-way flight by customer who flies remaining leg of journey on competing airline.

Exhibit 2 - Source: CRM in the air, 2002

See specific benefits of CRM to an airline organisation and to the customer in Table 1 below:

Airline Benefits
• Planning and implementing business processes across airlines and CRM applications ensures customers are handled in the most efficient and effective fashion from the beginning to the end of the interaction based on their real-time value to airlines • Implementing CRM applications may simultaneously lower the cost of design, implementation, installation, training, ownership and administration. It also reduces the risk of re-engineering systems at a later date • Consistent and dynamic processes are built up-front for the customer. This forces the airline to consider each element in the process design including the network, switch, multi-media management, and the CRM - ensuring streamlined processes are in

place before the customer makes contact. • Create and leverage detailed statistics/metrics and cradle-to-grave reports. • Real-time access to historical customer information allows support staff to know who your customer is, why the customer is calling, what's been done, what needs to be done, and respond in the most efficient, expedient manner possible. • An improved SCM based on better understanding of customer demands and needs through the effective passenger segmentation
Customer Benefits
• More satisfied customers will obtain more personalized, valuable service and information. • Personalization enabled promotion tailored to customer profile - enhancing one-to-one marketing. • Effective and efficient personal treatment or resolving customer concerns or queries on time without waiting • Better served customers according to specific needs and preferences

Table 1 - Source: Application of E-CRM to the Airline Industry

The use of a CRM will help to better manage customer data in an integrated manner where customers will be segmented in groups according to similar preferences and characteristics which will provide the airline with a better understanding of their consumer needs and expectations to improve the value-added service in future and thus increase sales. The most valuable customers to an airline can be identified and focused on to become loyal and serve as advocates to the airline. 'This strategy can improve sales effectiveness, bring higher value to all of airline's key business relationships, help airline to understand what each client relationship is truly worth, develop and reinforce a consistent experience for customers, improve management effectiveness, improve tactical and strategic planning, respond faster to competitive challenges, use critical resources more efficiently, and reduce administrative burdens and overall cost' (Jiang, 2003).

History of CRM & CRM software market overview

In the 1980s, the concept of CRM revolutionised large and small businesses with promises to radically change how business interacted with customers. Due to the expensive and difficult task of tracking customers as well as the lack of today's advanced technology, CRM was better in theory than in practice. It started with the emergence of marketing databases to collect customer contact details to identify customers and to collect survey-like information that did not add much insight. With the early 1990's companies began improving CRM by making it more dynamic, gathering information to not only improve customer service but also

to track customer activity and spending patterns as well as make them loyal (i.e. frequent flyer programs in the case of the airline industry). The true evolution in CRM capabilities improved drastically with the beginning of this century where newer software systems with advanced tracking features, complex metrices, customisation features for segmentation as well as database capacity and integration became prevalent. 'About 50% of the CRM market is currently divided between five major players in the industry: PeopleSoft, Oracle, Siebel, and relative newcomer Telemation, based on Linux and developed by an old standard, Database Solutions, Inc.' (Roberts, 2004). Microsoft CRM may capture a portion of the CRM market by leveraging their brand name and position. See Table 2 below for a snapshot of current market player's actions regarding CRM software.

CRM software market dynamics
In 2002, Oracle released their Global CRM in 90 Days package that promised quick implementation of CRM throughout company offices. Offered with the package was a set fee service for set-up and training for core business needs. . Also in 2002 (a stellar year for CRM), **SAP** America's mySAP began using a "middleware" hub that was capable of connecting SAP systems to externals and front and back office systems for a unified operation that links partners, employees, process and technologies in a closed-loop function. **Siebel** consistently based its business primarily on enterprise size businesses willing to invest millions in CRM systems, which worked for them to the tune of $2.1 billion in 2001. However, in 2002 and 2003 revenues slipped as several smaller CRM firms joined the fray as ASP's (Application Service Providers). These companies, including UpShot, NetSuite and SalesNet, offered businesses CRM-style tracking and data management without the high cost of traditional CRM start-up. In October of 2003, Siebel launched CRM OnDemand in collaboration with IBM. Their entry into the hosted, monthly CRM solution niche hit the marketplace with gale force. To some of the monthly ASP's it was a call to arms, to others it was a sign of Siebel's increasing confusion over brand identity and increasing loss of market share. In a stroke of genius, Siebel acquired UpShot a few months later to get them started and smooth their transition into the ASP market. It was a successful move. With **Microsoft** now in the game, it's too soon to tell what the results will be, but it seems likely that they may get some share of small businesses that tend to buy based on familiarity and usability. ASP's will continue to grow in popularity as well, especially with mid-sized businesses, so companies like NetSuite, SalesNet and Siebel's OnDemand will thrive. CRM on the web has come of age!

Table 2 - *Source: The history of CRM – Moving beyond the Customer Database, 2004*

An Airline CRM system

A CRM system and infrastructure should help in utilizing the customer segmentation approach to effectively target, retain and develop customer satisfaction in a personalised manner to build a loyal customer base by optimizing resource utilisation. A customer valuation model should be developed that focuses on current and future value to the airline of various customers and customer groups and any underutilised potential value and opportunities identified. A CRM system is a tool to identify and measure customer needs and preferences, the customer purchasing patterns, assist personalised treatment of customer, access to customer information and decision support to which customer receives what kind of treatment. In addition, a campaign management tool in order to establish an automated information structure and cultural change to transmit targeted offers to targeted customers or group of customers (Taneja, 2002). The main reason for the recent increase in the deployment of CRM is the development in the technology that makes it easier to be implemented and can be described as follows:

> *With these newer informatics technologies, airlines can track their customer on several data points, such as profitability, behaviour and level of satisfaction. This information is stored in a database that airlines can then mine to build more cost-effective relationships with those customers. It is essential that the data base be accurate, expandable, robust and 'minable'. In the context of CRM, term data mining refers to the use of analytical tools and techniques to analyse the customer data to (1) identify insightful patterns, and (2) interpret these patterns to design meaningful and timely marketing programs (Taneja, 2002)*

Specific CRM system benefits to an airline
• Provides an understanding of customer behaviour and enables airlines to measure results of marketing and merchandising changes. • Supports more effective promotions through integration of data between marketing and merchandising users. • Provides a single view of customers across the enterprise and across contact points (i.e. airports, internet, agents) • Gives airlines the ability to respond more dynamically and quickly to market demands. • Directly connect airlines and passengers. • Reduced cost of a customer contact. • Suppress time and place limits. • Support interactivity and therefore can dynamically adapt to customer behaviour. • To be able to satisfy customers' need, build customer confidence and retention. • Can be updated in real-time, therefore always up-to-date. • Enhance airlines competitive advantages over its rivals. • Profitable and sustainable revenue growth.

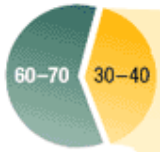
Table 3 - Source: Application of E-CRM to the Airline Industry, 2002

See Exihibit 4 for how to keep valuable customers happy and how CRM can be deployed to assist with different activities.

EXHIBIT 4

Keeping passengers happy

Reasons for customers' downward migration,[1] percent



Structural factors such as change in
- Job
- Location
- Personal circumstances

Nonstructural factors

Related to	Possible issues	CRM[2] actions
• Service	• Delays, lost luggage	• Identify and proactively apologize to high-value customers
• Frequent-flyer program	• Failure to redeem frequent-flyer points	• Provide high-priority frequent-flyer redemption certificates
• Product	• Dissatisfaction with seat design	• Initiate changes in future product design
• Competitors' offers	• Sales promotion in specific market	• Predict which customers may defect; offer appropriate discount
• Flight	• Availability of high-demand routes	• Ensure sufficient timing, frequency of scheduled flights preferred by high-value customers

[1]Choosing fewer or less expensive products or discontinuing use of products.
[2]Customer relationship management.
Source: 2001 McKinsey survey of 9 European, 5 North American, and 3 Asia-Pacific airlines

Exhibit 4 - Source: CRM in the air, 2002

How to implement CRM

In implementing a CRM system, it is assumed that the airline has an integrated ERP system in place with which the CRM will be linked. A decision has to be taken of whether to implement CRM in slam dunk way or as a phased project. The strategic vision and objectives of CRM should drive an initial process-reengineering as well as a change management effort within the airline prior to technology implementation. As mentioned before, the new business processes should reflect a true customer-centric organisation where everybody in the organisation is engaged in the CRM process. In order for the CRM process to become successful, the airline must align strategy, objectives, processes, employees and technology in a customer-focused environment. Some critical CRM system implementation success factors are listed in Table 4 below.

Critical CRM system implementation success factors
• An overall customer-oriented strategy clearly communicated where top management sponsorship of the process, management change, technology implementation and change of focus from product to customer exists

- Prepare and train employees to be able to connect and deploy the data and information from CRM systems to build an effective customer relationship where the service is personalized and focused on satisfying each unique customer needs. Staff training and motivation will be key to fulfill this goal
- The CRM process should be deployed company-wide where data captured and analysed is used by everyone in the organisation to improve activities that will maximise customer satisfaction. Customer expectation is measured by Marketing and Sales people but performance is in the hands of operations
- The need to have integrated data uses across different interaction points with the customer. Data extraction and analysis should easily be used on time
- CRM should be configured properly and aligned with processes to optimize the benefits from a CRM as well as understanding customer unique needs, preferences and his value proposition. Benefits from CRM should outweigh the investment in the system
- CRM system should be used as a means to personalize the relationship between the airline and the customer and thus will not in itself guarantee an improved CRM unless it is efficiently used
- A CRM system implementation is just a step-stone in improving the relationship between organisation and customer. An evolution in CRM process should continually improve to realize incremental benefits from improved customer satisfaction. *'CRM involves front- and back- office business processes that require accurate and easily accessible data. Access to poorly integrated front- and back office processes and a lack of quality in the underlying data within the foundation applications will lead to ineffective customer service and a resulting erosion of customer loyalty' (Gartner Group)*

Advanced Planning & Scheduling (APS)

Why APS matters

The operational environment of an airline business is very complex due to the large size, wide network and the continuos daily operation in addition to the weather conditions, government regulations, maintenance, crews as well as the public environmental concerns like pollution and noise. Operational planning and scheduling optimisation becomes key to the success of any airline organisation in this competitive and complicated arena. For a long time, the airline industry has relied heavily on network, fleet, schedule, crew, maintenance and airport facility planning. 'Schedule development models, for example, based on operations research, attempt to maximise the profitability of a proposed schedule by taking into consideration a broad spectrum of variables' (Taneja, 2002). These analytical models take into account market capacity (passengers, cargo, competitive schedules), resources (aircraft, crews, maintenance facilities) as well as constraints (route authority, airport facilitates, government regulation). They also help maximise revenue on the basis of price. Exhibit 5 below reflects the complexity that an airline business faces.

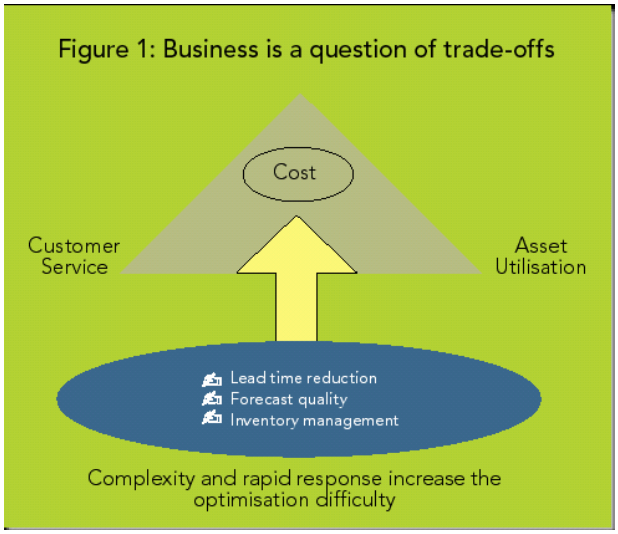


Exhibit 5 – Source: Working on the chain gang, 2004

APS benefits to the airline

APS as an emerging decision support system can help work on a real time basis and optimise operations on a cross-functional level by benefiting from emerging advanced technology. The airline industry must operate in a highly variable demand market with high fixed costs and sometimes has to operate in an environment where some variables are out of its control (air

traffic control and weather conditions); thus airlines have to respond quickly to any changes on a real time basis and most importantly respond in an integrated manner cross-functionally. Most airlines have become sophisticated at optimising individual activities on a functional level such as aircraft and crew scheduling, maintenance scheduling, sales, pricing and revenue management. However, because of disintegration between functions, planning and scheduling is somehow inefficient and eliminates the opportunity of real time cross-functional response to any changes. The disintegration of processes and functional planning undermines the holistic picture and the performance vision of the company as a whole and its relationship within the whole supply chain. Here again comes the importance of a change from a product to a customer-centric organisation where all functions should work together to highly satisfy customer needs. In order to compete in today's overwhelming fast-pace market, cross-functional scheduling and planning is key to survival and here again comes the role of an APS. See benefits of APS for an airline in Table 5 below.

Benefits of APS for an Airline
• Visibility across the whole supply chain • Better understanding of individual department to how their processes and activities contribute the overall performance of the organisation • More understanding and collaboration between suppliers and the airline and how the combined activities will affect overall airline performance (i.e catering services) • Relationships between deparments and their activities become visible. Implications of a change in one function on another (i.e. delays and crew planning) • Improved reporting will help management better in performance measurement and take action to any required improvements that become visible on-time. • Strategically making the holistic operations visible • Improved forecasting and a better match between demand and supply (Relationship between a CRM and APS can be of great benefit) • Enhanced revenue and cost reduction and consequently profits by optimising cross-functionally • Customer with high expectations will be provided with better service due to more planned and flexible operations • Airlines have better control over irregular operations or variations from schedules. Operations such as catering, ground services, maintenance could comprise this category • Cross-functionally across the airline, everyone can keep track of the operations of others so that everybody is working as part of one whole big team • Shorter scheduling cycles • Shorter lead times • Shorter maintenance cycle

Table 5 - Source: Driving airline business strategies through emerging technology, 2002

An APS enables the airline to have better understanding and control of the interrelationship between different variables that make up the total performance. These interrelationships that are complex and hard to measure can be manipulated by deploying an APS in a proper way and incorporated as previously mentioned in a cross-functional approach. A good example could be the effect of a delay due to airport facilities on the rest of the variables and how APS can help plan in advance for such a situation and enable taking proper action to contain the situation. 'In general, the broader the scope of an airline's cross-functional vision, the more likely the airline will be to incorporate those functions in a total system management program, and the easier it will be for an airline to maximise performance within each function and throughout the total airline' (Taneja, 2002).

APS History and APS market

Manufacturing resource planning (MRP) and ERP systems lacked the optimisation capabilities and thus Operation Production Technology (OPT) was invented in the 1980s to address optimisation issues (Kruse, 2004, October). Since then, supply chain optimisation software developed and became more complex with emerging advances in technology and database capacity. Although many key features of APS did not change and is still a decision support system which data is still fed back into ERP for execution the real expansion of APS capability is in the following areas:

- The ability to develop integrated processes with forecasting, demand management, inventory, replenishment management and synchronised scheduling and planning capabilities
- The deployment of web-based technology for real-time interaction and updating (web-based collaboration)
- Extension of supply chain across to customers and suppliers
- Highly advanced and sophisticated supply chain analytics tools are developed

'The market has been traditionally led by 'best of breed' specialists such as i2 and Manugistics. Since then a number of ERP vendors, notably SAP, have added SCO to their products' (Kruse, 2004). Currently because the APS functionality is still new to ERP vendors, the best of breed option has an upper hand. This is due to high and specialised functionality, low cost of implementation and running of the software as well as rapid implementation by specialised APS vendors.

What is a APS and its role in the supply chain management

The ultimate objective of supply chain management in business is to 'to perfectly match the supply side activities of procurement, production planning, distribution planning, production allocation, warehouse planning, inventory planning and so forth with the demand side

activities of incoming orders and forecasts so that all demands are met with the least cost' (Ahmed, 2004, June19). The conventional ERP system lacks the flexibility and intelligence to fulfil this objective and CRM as mentioned above only focuses on one part of the equation, namely demand. To complete the picture and balance the supply and demand side, the advanced planning and scheduling (APS) which is also called 'supply chain optimisation' enables the business to gear its activities in tandem with customer requirements. APS mixes and matches customer orders, divides orders, matches similar ones and forecasts future fulfilment requirements, checks availability of resources and sets order priorities. This data is then fed into other various supply chain execution systems like inventory control. 'In other words, whereas other systems act as enablers to do the business activities; this optimisation tool works as the brain behind all supply chain activities' (Ahmed, 2004, June19). APS technology is based on the complex algorithm programming. See Exhibit 6 below for a generic supply chain optimisation solution.

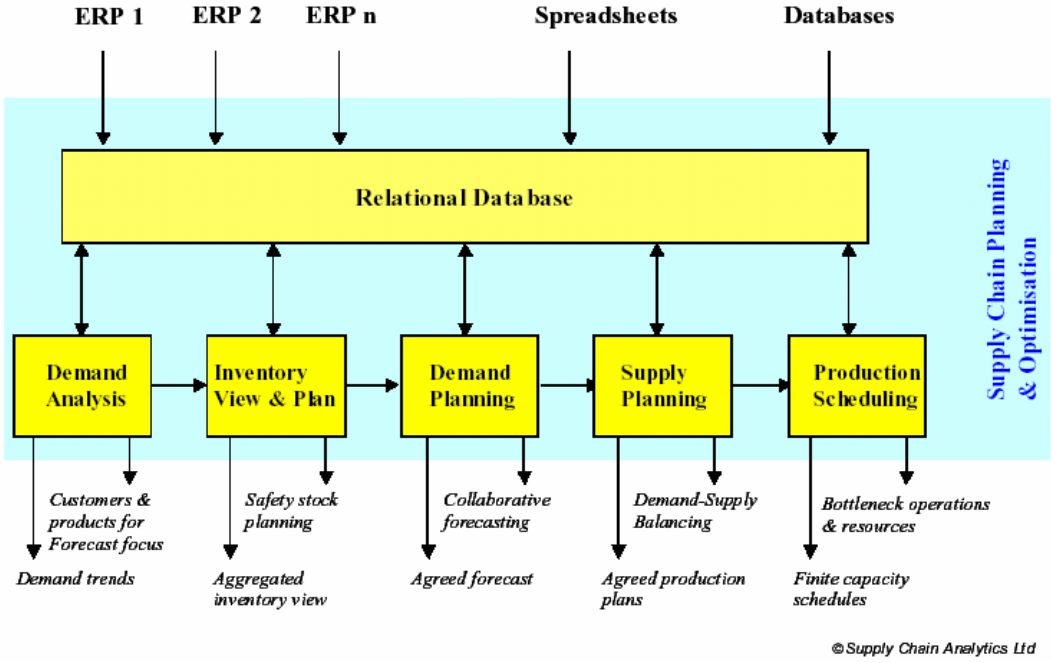


Exhibit 6 - Source: Supply chain optimisation – simple approaches for a complex world

Implementing advanced planning optimisation software is as complex as the underlying supply chain. Supply chain modelling and optimisation is and should only be an approximation of reality where the relative accuracy is improved to what planning and scheduling tool is already in use (Ross & Carter, n.d.). Technology in this case is an enabler that helps airlines have more visibility across their whole supply chain, better match the demand side with the supply side activities as well as gaining competitive advantage.

SECTION THREE

Introduction

The previous section discussed in depth how CRM and APS can deliver improvements to the airline industry, especially in managing efficiently and effectively the customer relationship and supply chain operations of an airline as well as balancing the demand side with the supply side. In this section, the assessment of which software vendors provide the most suitable CRM and APS software (as recommended in the first section) for the airline as well as for the industry.

Software vendors for CRM system

The competition in this software market is growing fierce as more than 80 vendors have been founded and developed similar CRM functionality. Most of them are capable of providing basic CRM functionality which provides personalised and multi-channel customer services, sales force automation and market analytical tools. However, few of them managed to provide value-adding functionality in addition to the basic functionalities, such as campaign and promotion management tools or single-face portal (web enabled CRM) as will be discussed.

Alternative CRM Vendors

Epiphany

Epiphany is one of the leading CRM providers. Epiphany has successfully utilised CRM concepts and provided tools that enabled effective CRM processes which focused on customer-centric activities. Epiphany's CRM has been used by 475 companies around the globe (including KLM, Japan Airlines, and American Airlines) and has developed expertise in airline-specific functionality needs (Epiphany, 2005).

Functions

- *Sales force automation*

  This function maximizes sales efficiency and improves sales productivity. Automating the sales procedure, this function provides best-practice standardised selling methodology across the whole organisation. Sales force automation also shares and updates information to sales teams and managers on a real-time basis. This enables visibility and seizing opportunities more effectively. This will in turn enhance airline company's profitability and have the insight they need to forecast accurately and drive revenue more effectively (Epiphany, 2005).
- *Multi-channel customer service contacts*

Emphasising its multi-channel contact center solution, Epiphany knows exactly how to capture customer interactions from both traditional and online channels. Leveraging an intelligent knowledge platform and a single contact interaction record, airline customers are always presented with accurate, relevant information, ensuring a rich experience and increased loyalty (Epiphany, 2005)

- Marketing campaign management and automation

  This function analyses the customer data recorded and identifies precisely the market needs (i.e. seasonality). It then suggests efficient, targeted and automated marketing campaigns to targeted customer segments according to their needs and preferences at the right time with the least cost. In conclusion, this function ensures airline companies effectively deploy their marketing budget and not waste it on customers who are not valuable to the airline (Epiphany, 2005).

- Personalised marketing approach (one-to-one customer relationship management)

  Vast and dynamic customer database capacity enables Epiphany to provide personalised approach to its customer. Specific promotion can be tailored differently for each customer. Thus, airline companies can better penetrate their market and effectively provide relevant information to their customers which, ultimately, can increase customer satisfaction level (Epiphany, 2005).

- Integrated portal

  Epiphany also provides secure and personalised portals for airline companies. Therefore, every customer can have access to web-based information that is relevant to him and the airline companies can have their promotion tailored to certain customers or customer group (Epiphany, 2005)

- Marketing Analysis

  Epiphany advances analytics enable airline companies to do churn analysis, profitability analysis, frequent flyer identification, customer satisfaction identification which, in turn, provides them with more accurate information to formulate their marketing strategies (Epiphany, 2005)

Benefits of Epiphany CRM

- Improved sales effectiveness

  With robust functionality, processes configuration, opportunity identification, pipeline forecasting, and sales analytics, Epiphany provides a single, comprehensive view of corporate sales performance across all sales channels. This enables effective sales management to better manage different aspects of sales strategy and execution (Epiphany, 2005).

- Increased customer acquisition rates

  With a single Epiphany solution, airlines can analyse customers, identify target lists, optimise planning and target campaigns. Epiphany helps organisations convert

potential valuable customers into real ones, hence improve customer acquisition rates (Epiphany, 2005).

- Improved customer retention

  Through Epiphany's integrated analytics, airline companies can uncover insights contained in their customer data and improve their understanding of customers. In addition, Epiphany provides capabilities to monitor operational processes for preventing defection events from taking place and triggers real-time response. As a result, companies can plan and prevent losing customers before this occurs (Epiphany, 2005).

- Provide a single view of customer profiles

  By leveraging existing legacy data sources, Epiphany delivers a single view of the customer and provides one-click access to all relevant customer data company-wide. To accomplish a single view of the customer, Epiphany complements existing technology investments rather than replacing systems that have serviceable years remaining. This approach ensures fast time to market, delivers high ROI and minimizes disruptions to business operations (Epiphany, 2005).

Siebel

Like Epiphany, Siebel is the other main contender in the airline CRM market competition. Siebel is arguably the biggest CRM provider in the world. Serving more than 4000 customers, Siebel proved to have extensive experience in developing CRM system (Siebel, 2005). Covering every single aspect of CRM concept, Siebel provides the best CRM yet to airline companies.

Functions

Siebel provides all the function that Epiphany can offer. Furthermore, Siebel also introduces partner relationships management as part of its CRM system. This function enables airline companies to more effectively and strategically manage their alliance networks (in this case – travel agents). It enables the company to effectively manage the entire alliance life cycle, from recruitment, registration, profiling, certification, joint planning and execution through measurement and analysis of partner performance. This way, the airline company can control its travel agents, thus increasing their service quality to customers.

Benefits

Siebel CRM system goes beyond creating new market opportunities, by maintaining and increasing service quality to its existing customers, and also enable the airline to control its alliances (i.e. agents). Therefore, Siebel provides a comprehensive value-adding tool to effectively manage the airline's CR.

RightNow Technology

RightNow Technology, founded in 1997, is also a top-tier CRM vendor focusing on services industries. RightNow already has 1,200 CRM customers around the world, such as British Airways, British Telecom, Cisco Systems, Continental Tire North Americian, Johon Deere, Nikon and the Social Security Administration. Its on-demand solutions offer comprehensive functionality without the complexity of traditional software, enabling a shorter time to running and a faster return on investment in the industry. (RightNow, 2005).

Functions

RightNow CRM system provides similar services as Epiphany. However, lack of an integrated portal feature disadvantages RightNow as compared to Epiphany.

Benefits

RightNow provides the same benefits as Epiphany except for providing integrated portal. The only drawback is that RightNow cannot provide the airline with the advantage of web-based capabilities.

Exact Software

By 2005, Exact were already providing more than 180,000 customers in 120 countries. Exact CRM system is a mid-tier CRM that only provides web-based business management solution that enables customer relationship management.

Functions

Exact CRM system can only provide three functions of the CRM concept.

- Provide secure and personalised customer and partner portal (Exact, 2005).
- Marketing campaign management and automation (Exact, 2005)
- Customer-specific reports and statistics
  Exact provides customer-specific reports and statistics. However, Exact does not provide any analytical tools which airlines should have (Exact, 2005).

Benefits

Exact CRM does not really differentiate its product from other CRM's but only provides basic tools.

Surado

Surado's products are used in all states of US and more than 64 countries in the world. Surado's CRM is designed to best service medium sized enterprises, which providing fast

user acceptance, quick return on investment, and high-value customer experiences (Surado, 2005).

Functions

Surado provides similar functions as RightNow system. Sales automation, marketing automation, customer service, marketing analysis tools are the main Surado system services. Surado CRM is designed to provide faster system performance rather than system capacity (Surado, 2005).

Benefits

Surado provides same benefits as RightNow system. However, Surado's vision in providing best services to medium sized enterprises will restrain airline companies in applying its system (Surado, 2005) as Surado's compatibility to support big enterprises is questioned.

CRM Vendors Recommendation

Before looking into the recommendation, see Table 6 for a summary of CRM vendor capabilities.

Summary of CRM vendors' capabilities

CRM Functionalities and readiness to implement on big enterprises	Epiphany	Siebel	RightNow	Exact Software	Surado
Sales force automation	√	√	√		√
Multi-channel customer service contacts	√	√	√		√
Marketing automation	√	√	√	√	√
Marketing campaign management (i.e.: seasonality identification)	√	√	√	√	√
Personalized marketing approach (one-to-one customer relationship management)	√	√	√	√	√
Integrated portal	√	√		√	
Churn analysis	√	√	√		√
Profitability analysis	√	√	√		√
Frequent buyers identification	√	√	√	√	√
Customer satisfaction identification	√	√	√	√	√
Sufficiency for big and global enterprises	√	√	√	√	
Partner Relationship Management (relationship with travel agents)		√			

Table 6

As shown in Table 6, one could see that Siebel is the top vendor in providing the most suitable CRM to an airline. Its partner relationship management ability is crucial to airlines as they will enable them to better control of its travel agents. Second, RightNow and Epiphany offer similar services; however, Epiphany holds a better rank as it is more capable of providing the integrated portal function.

Exact Software and Surado capabilities in providing a good CRM system for an airline is questionable. The lack of Exact's capability in providing analytical tools disadvantages its chances to provide a competitive edge for airlines. Surado on the other hand, lacks the capability of providing proper infrastructure for big and global enterprises which eliminates Surado to be considered appropriate for the airline industry.

See Table 7 for a summary of recommended CRM software vendors by rank.

List of Recommended CRM Vendors for airline industry	Inappropriate CRM vendors for airline industry
1. Siebel 2. Epiphany 3. RightNow	• Exact Software • Surado

Table 7

Software Vendors for APS System

There are more than 30 vendors in the APS market. The market segment itself is still in a growing process and each vendor is still struggling in finding its place within that market. Many vendors only have industry-specific experience and few have experience in the airline industry.

The following discussion will focus on those vendors with previous airline industry experience. Below are list of characteristics those vendors have:

- Extensive experience in airline industry (has successfully implement their software in at least five aircraft/airline companies) and
- Top-tier vendors (possess viability and credibility) with wide ranged APS functionality or mid-tier vendors that can differentiate themselves from the top-tier.

Alternative APS Vendors

i2

i2 is a top-tier player in the APS market. It has experience in many industries and provides wide APS functionality. In the airline industry itself, i2 has been used by many big companies such as Airbus, Lockheed Martin and Southwest airlines. (i2, 2005)

In the case of the airline industry, i2 provides tools that can deliver its users with revenue enhancing opportunities, better inventory management and enhance visibility and collaboration across the supply chain.

Functions

i2 delivers four main functions for airline industry:

- *Optimised order fulfilment*

  This function provides a single interface to customers as well as optimal customer experience through proactive supply chain visibility, accurate real-time responses to requests and improve delivery performance. Therefore, customers' satisfaction will increase (i2, 2005).

- Optimized organisation sourcing and procurement.

  This supports sourcing decision in reducing cost of product variety, increasing production success and optimising procurement activities. Enabling collaboration between airlines and its supplier, meeting specific design will be done more quickly and with reduced cost. This is important to aircraft companies as their complex sourcing and procurement can be managed more properly and efficiently (i2, 2005).

- Optimized supply planning and demand forecasting.

  More accurate demand forecasting and supply planning and scheduling functionalities are provided(i2, 2005).

- Providing spare parts management

  This functionality will enhance aircraft design to order fulfillment and execution. The solution can provide a comprehensive set of capabilities necessary to transform the supply chain into an agile network that fulfil the order at the lowest costs possible (i2, 2005).

Benefits

- Exercise economies of scope principle

  By sharing schedules and plans, airlines can run multiple product lines, create more flexibility and satisfy more constraints with less resources (i2, 2005).
- Gain visibility

Through order fulfilment services, airlines can have the visibility to analyse its suppliers activities until customer orders are fulfilled (i2, 2005).

- Better sourcing, faster launches

  Through design collaboration, and smarter sourcing decision, companies will be able to quickly meet specific aircraft design while reducing the lifetime cost of supporting an asset (i2, 2005).

- Gaining greater connectivity

  Collaboration and integration across multiple enterprises allows the entire value chain to be aligned and linked (i2, 2005).

Manugistics

Manugistics is another top-tier player in the APS market that has extensive experience with many industries by deploying a wide APS functionality. Manugistics APS has been used by many big companies such as Boeing, DHL, KLM, El Al airlines, Continental airlines (Manugistics, 2005).

Functions

While Manugistics is providing similar services to i2, Manugistics adds its support with providing price-sensitive revenue management tools for airlines. This solution helps airlines maximize revenue and profits by accurately forecasting future demand, optimising pricing strategies and optimally allocating capacity, based on passenger price sensitivity as a key driver (Manugistics, 2005). This is very crucial to airlines, as they often fail in making profits due to ineffective pricing strategies (Morrison and Winston, 1995).

Benefits

High capacity allocation and price optimization tools and are as good in terms of functionality as i2.

Oracle

Oracle is one of the leading vendors in providing enterprise systems. Oracle provides services to main aircraft manufacturers such as Boeing, General Dynamics and Lockheed Martin. Supported with its own database infrastructures, Oracle holds better credibility in integrating its APS system with its database applications. However, due to its very large system scope, Oracle was not able to specialise APS functionality. Oracle's focus is mainly on optimising airline maintenance planning and inventory optimisation. (Oracle, 2005)

Functions

Three main functions that are offered by Oracle:

- Complex Maintenance, Repair and Overhaul

This function enables aircraft companies to maintain complex configurations, plan enterprise-wide maintenance operations, optimise maintenance execution and improve regulatory requirements.

- Demand Planning and Inventory Optimisation

  This function enables aircraft companies to manage spare-parts more efficiently and reduce inventory costs.

- Enterprise Sourcing and Procurement

  This function links all facilities and ground support equipment service and maintenance to all business functions. It integrates sourcing and procurement activities, enabling supplier communication. Hence, it will improve aircraft companies increase maintenance parts quality and speed up procurement process.

Benefits

Oracle products will highly increase aircraft companies maintenance quality. This is very critical to airlines as well. As maintenance providers are able to shorten over-haul time, it means that airline companies will get their aircrafts maintained in shorter times. Thus, they can utilise their fleets more frequently, and ultimately, can increase fleet flying time.

SAP

SAP is also another competent vendor in enterprise systems. Its high expertise as top ERP provider, gives SAP a deep understanding in integrating its APS system with ERP. SAP also has reasonable experience in the aircraft industry.

Functions

Similar to Oracle, SAP also focuses in providing optimisation for maintenance operation. However, route profitability analysis tools enable airline companies to conduct analysis for planning efficient routes (SAP, 2005).

Benefits

SAP has similar functionality as Oracle. However, due to its added route profitability functionality, SAP can offer better services than Oracle in terms of route planning capability. SAP does not only will deliver optimal maintenance and aircraft utilisation, but also provide better route planning which leads to revenue increases.

E-gatematrix

E-gatematrix is a mid-tier vendor focusing on in-flight service management (i.e.catering management). This vendor is a subsidiary of GateGourmet, a global catering services provider. E-gatematrix products have been widely used in airline industry. Big airline

companies such as Cathay Pacific, Singapore Airlines and KLM have flourished much benefit from it (e-gatematrix, 2005).

E-gatematrix cleverly differentiates itself from the other APS vendor because of its specific and focused vision in providing in-flight service management. E-gatematrix found its niche market where other competitors are competing in higher level APS system. Supported with its parent company's core competency in providing catering services for the airline industry, E-gatematrix possess a competitive advantage compared to other competitors (e-gatematrix, 2005).

Functions

In-flight service management that e-gatematrix provides, include: service scheduling, menu specifications, galley planning, logistics/asset management (for catering purposes), service ordering, invoicing, service pricing, and performance tracking. E-gatematrix focuses on improving airline in-flight services, assuring that the airline provides best quality in doing their in-flight services efficiently and effectively (e-gatematrix, 2005).

Benefits

E-gatematrix provides optimal in-flight services management and planning, thus enable airline companies visibility to organize its in-flight services. Furthermore, E-gatematrix considers its products as an added value in SCM system and is designed to complement airline's existing SCM and ERP.

APS Vendors Recommendation

See Table 8 as a summary of APS vendors capabilities.

APS Functionality	i2	Manugistics	Oracle	SAP	e-gatematrix
Supply planning and scheduling	√	√		√	
Demand forecasting	√	√			
Demand planning	√	√	√		
Supplier collaboration	√	√			
Order monitoring	√	√			
Maintenance planning and scheduling	√	√	√	√	
Maintenance monitoring	√	√	√	√	
Sourcing and Procurement optimization	√	√	√		
Procurement planning and scheduling	√	√	√		
Price optimization		√			
Revenue management		√		√	
In-flight service management					√

Table 8

As the table shows, one can conclude that the recommendation must be divided into two categories in order to provide an all-rounded APS functionality as well as specific APS functionality. It is recommended that airline companies should implement both these categories as they complement each other.

- All-round APS functionality
    - Manugistics and i2 extensive functions outrun the other APS vendors capability and give them the leading position in providing all-round APS functionality. Manugistics and i2 products focus on all APS aspects while other can only focus in just one or two aspects (i.e: Oracle and SAP with its maintenance management focus)
    - Manugistics and i2's extensive experience in airline industry also put into account, as they understand really well what the airline industry needs in improving their business and how to put their products in that place.

- However, Manugistics provide better functions than i2 as they provide tools for price optimization and planning as well as revenue management which i2 did not possess.

- Specific APS functionality
  - E-gatematrix differentiation from other APS vendors majority enable it to survive the competition. Its focus on providing in-flight services management complements the all-round APS functionality, giving its customers better advantages from their competitors who use other APS systems.

Vendors like Demantra, Supply Chain Consultants, and Numetrix should be put out of competition as they lack airline industry experience.

Here is a complete list of recommendations for airline industry regarding APS Vendors (Table 9).

List of Recommended APS Vendors for airline industry	List of not good APS vendors for airline industry
1. Manugistics 2. i2 3. Oracle or SAP • e-gatematrix (as added value)	• Demantra • Supply Chain Consultants • Numetrix

Table 9

CONCLUSION AND FINDINGS

The airline industry is a well-established strategic industry with a wide and broad complicated structure due to industry size, broad networks and intense competition. The industry that saw a downfall after the September 11 attacks will see radical changes in future and thus industry firms should be prepared to respond to those changes if they are to survive. The focus of airline organisation should shift from a product focused to a more customer focused one in which business activities evolve around satisfying customer needs at the lowest cost and in the most efficient way. Thus, CRM will play a major role in the survival of any airline and airlines should deploy this tool to better manage their complicated relationship with their customers and understand their unique needs and preferences to enhance the customer servicing experience. In order to meet demand, airlines are suggested to deploy the highly advanced APS systems in order to better interact with their suppliers, plan, forecast and optimise resource utilisation in order to be able to balance the demand side with the supply side. It is suggested that two vendors can fulfil the system implementation in the most suitable manner to the airline industry. Those vendors have a better potential to satisfy the airline industry software requirements mainly due to their functionality capabilities and high expertise within their respective software market segments. Those vendors are Siebel for CRM and Manugistics in the case of APS implementation.

References

Bingelli U., Gupta S. & Carlos De Pommes (2002, March 1), CRM in the air, *The McKinsey Quarterly.* Retrieved May 20, 2005, from http://www.marketingpower.com/content17912C800.php

Jiang H. (2003), Application of E-CRM to the airline industry. Retrieved May 20, 2005, from http://ausweb.scu.edu.au/aw03/papers/jiang/paper.html

Flagnan T. & Sadie E. (1998), Building a successful CRM environment, *The Technology Guide Series, techguide.com.* Retrieved May 20, 2005, from http://www.itpapers.com/techguide/bldgcrm.pdf

Roberts L.P. (2004The history of CRM – Moving beyond the customer database, *Evalueseek Publishing.* Retrieved May 20, 2005, from http://ezinearticles.com/?the-history-of-crm----moving-beyond-the-customer-database&id=6975

Gartner Group Report. From Jiang H. (2003), Application of E-CRM to the airline industry. Retrieved May 20, 2005, from http://ausweb.scu.edu.au/aw03/papers/jiang/paper.html

Taneja N.K. (2002), *Driving airline business strategies through emerging technology,* 1st ed., UK: Ashgate Publishing Limited.

Ahmed A. (2004, June 19), Brain of supply chain system*, Technology Evaluation.com.* Retrieved May 20, 2005, from ERP 306-674 Reading Pack, Semster 1 2005, Melbourne University.

Ross A. & Carter D. (n.a.), Supply chain optimization – simple approaches for a complex world, *Supply Chain Analytics Ltd.* Retrieved May 25, 2005, from http://www.supplyanalytics.com/pdf/SupplyChainOptimisation.pdf#search='supply%20chain%20optimisation%20simple%20approaches%20to%20a%20complex%20world'

Kruse G. (2004, October), Working on the chain gang, *Equipment News.* Retrieved May 25, 2005, from http://www.supplyanalytics.com/pdf/MENsoftwareSystem.pdf#search='working%20on%20the%20chain%20gang%2C%20Kruse'

Boeing Website, (2005). Retrieved May 25 from http://www.boeing.com/companyoffices/aboutus/brief.html

Airbus Website, (2005). Retrieved May 25 from http://www.airbus.com/about/euro_manufact.asp

Grant R. (2005), *Contemporary strategy analysis,* 5th ed., Case study 3, Retrieved from Strategic Management Subject, Semester 1 2005, Melbourne University

Sheehan, J. J. (2005), *Business and Corporate Aviation Management.* McGraw-Hill Publisher, New York, US.

Morrison, S. A. & Winston, C (1995) *the Evolution of the Airline Industry.* The Brookings Institution, Washington, D. C.

Investopedia Website, (2005). Retrieved May 25 from http://www.investopedia.com/features/industryhandbook/airline.asp

The Emerging Airline Industry, Joint study, A.T Kearney and the Society of British Aerospace companies, July 2002.
Epiphany (2005) Corporate website. Available online: http://www.epiphany.com
Last accessed: 27 May 2005

Siebel (2005) *Corporate website*. Available online: http://www.siebel.com
Last accessed: 27 May 2005

RightNow (2005) *Corporate website.* Available online: http://www.rightnow.com
Last accessed: 27 May 2005

Exact (2005) *Corporate website.* Available online: http://www.2020software.com/products/e-Synergy_Customer_Relationship_Management.asp Last accessed: 27 May 2005

Surado (2005) *Corporate website.* Available online: http://www.suradocrm.com
Last accessed: 27 May 2005

I2 (2005) *Corporate website.* Available online: http://www.i2.com/.
Last accessed: 27 May 2005

E-gatematrix (2005) *Corporate website.* Available online: http://www.e-gatematrix.com/ecw/
Last accessed: 27 May 2005

Manugistics (2005) *Corporate website.* Available online: http://www.manugistics.com
Last accessed: 27 May 2005

Waer Systems (2005) *Corporate website.* Available online: http://www.waersystems.com
Last accessed: 27 May 2005

Oracle (2005) *Corporate website.* Available online: http://www.oracle.com
Last accessed: 27 May 2005

SAP (2005) *Corporate website.* Available online: http://www.sap.com
Last accessed: 27 May 2005

Sheehan, J. J. (2005) *Business and Corporate Aviation Management.* McGraw-Hill Publisher, New York

Morrison, S. A. & Winston, C (1995) *the Evolution of the Airline Industry.* The Brookings Institution, Washington, D. C.

Oum,T. H. & Yu, C. (2000) *Shaping Air Transport in Asia Pacific.* Ashgate, Aldershot.