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E-commerce relationship marketing

Guest Editors: Jerry Fjermestad and Nicholas C. Romano, Jr

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E-commerce relationship marketing
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Contents

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Abstracts & keywords

three fold. First, we introduce Hofstede's cultural dimension of uncertainty avoidance to the study of cross-cultural e-commerce adoption model. Second, we apply the theory of planned behavior perspective to capture behavioral intentions to transact online in two dissimilar countries – Greece and the US. Finally, the paper discusses several insights from this exploratory study that enrich the cross-cultural e-commerce literature.

Text clustering and summary techniques for CRM message management

Dmitri Roussinov and J. Leon Zhao

Keywords Knowledge management, Customer relations, Information exchange, Worldwide web

One of customer relationship management (CRM) activities involves soliciting customer feedback on product and service quality and the resolution of customer complaints. Inevitably, companies must deal with large number of CRM messages from their customers either through e-mails or from work logs. Going through those messages is an important but tedious task for managers or CRM specialists in order to make strategic plans on where to place the resources to achieve better CRM results. In this paper, we present a methodology for making sense out of CRM messages based on text clustering and summary techniques. The unique features of CRM messages are the short message length and frequent availability of correlated CRM ratings. We propose several novel techniques including organizational concept space, Web mining of similarity relationships between concepts, and correlated analysis of text and ratings. We have tested the basic concepts and techniques of CRM Sense Maker in a business setting where customer surveys are used to set strategic directions in customer services.

E-relationship marketing: changes in traditional marketing as an outcome of electronic customer relationship management

Shannon Sue Scullin, Jerry Fjermestad and Nicholas C. Romano Jr

Keywords Customer relations, Electronic commerce, Relationship marketing

Marketing concepts and definitions have remained relatively unchanged until recently. Electronic customer relationship management (eCRM) has forced marketing managers to reevaluate how, when and to what extent they interact with their customers. This paper is focused on the role of specific marketing concepts and how eCRM has enhanced or altered each concept. Every topic discussed is illustrated with current business examples. Several examples from the business trade press are used to illustrate the success an organization can achieve when using eCRM to enhance marketing skills.

From "ancient" to "modern": a cross-cultural investigation of electronic commerce adoption in Greece and the United States

Lin Chai and Paul A. Pavlou

Keywords Electronic commerce, Cross-cultural studies, Relationship marketing, Consumer behaviour, Customer relations

Globalization and the ubiquitous nature of the Internet facilitate e-commerce activities across nations. An empirical study was conducted using data from Greek and US consumers in order to obtain a better understanding of cross-cultural e-commerce adoption. The results give support for the proposed hypotheses, emphasizing the moderating role of cultural differences on consumer e-commerce adoption. The unique contributions of this paper are

SiteQual: an integrated measure of Web site quality

Harold W. Webb and Linda A. Webb

Keywords Electronic commerce, Information, Service quality assurance

The development and testing of an instrument for obtaining user feedback on the overall quality of B2C electronic commerce Web sites, SITEQUAL, is discussed. Using previous research in information quality and service quality as a springboard, a conceptual model and an instrument to measure Web site quality were developed. A factor analysis was conducted which suggested that four minimum Web site quality factors and seven desired Web site quality factors are important to consumers in the retail music industry. The use of Web site quality factors for measurement of consumer expectations

and perceptions, determining Web site requirements, and guiding the testing process is suggested.

The impact of e-marketplaces on dyadic buyer-supplier relationships: evidence from the healthcare sector

A. White and E.M. Daniel

Keywords Electronic commerce, Buyer-seller relationships, Health services sector

This study seeks to explore the impact of e-marketplaces on dyadic buyer-supplier relationships in the healthcare sector. In particular it seeks to determine if the "move to the middle" hypothesis put forward by Clemons *et al.* will be supported in this domain. Case studies of four buying organisations in the healthcare sector (hospitals) and two suppliers (medical device companies), representing eight dyadic buyer supplier relationships were undertaken. It was found that the adoption of e-marketplaces is associated with a reduction in the number of suppliers used by the buying organisations; a deepening of the relationship with the remaining suppliers and an increased "blurring of the boundaries" between the two parties.

Integrating diverse ERP systems: a case study

Sarmad Alshawi, Marinos Themistocleous and Rashid Almadani

Keywords Resource management, Case studies, Customization

Enterprise resource planning (ERP) went through many development cycles since its beginning in the 1970s until it established itself as a backbone of most major enterprises in the world. In spite of its countless advantages, most ERP implementations require heavy customisation to achieve their proclaimed advantages. This paper represents an endeavour to investigate, through a case study, the feasibility of minimising the heavy customisation required by most ERP implementations by selecting the best modules from each vendor and integrating them using enterprise application integration technologies, to form one (integrated) system. In doing so, the paper provides a description of a way to implement a suggested integrated solution, as well as a discussion of how minimising customisation enables enterprises to upgrade their ERP software effortlessly and cost-effectively.

Guest editorial

E-commerce relationship marketing: introduction to the special issue

E-commerce marketing is at the intersection of information systems technology (i.e. supply chain management, enterprise resource planning, customer relationship management), traditional marketing, and the customer interface. In the broader sense E-commerce marketing is comprised of electronic-based activities that facilitate manufactured goods and services by the producer to satisfy the wants and needs of the consumer. To this end, E-commerce marketing is concerned with strategies to persuade customers to purchase online, market research, distribution, customer relationship management, and customer satisfaction.

The theme of this special issue of the *Journal of Enterprise Information Management* is E-commerce relationship marketing research, which consists of software and analytical methods to coordinate online market research, build Web sites to facilitate and promote online buying, and to understand customer preferences so as to increase sales and retain economically valuable customers.

Several different calls for papers were issued, a general call in IS World, filers at the Hawaii International Conference on Systems Science and at America's Conference on Information Systems. We also sent e-mails to researchers all over the world to elicit papers. We received 22 papers and accepted five.

The first paper by Scullin, Fjermestad and Romano discusses the changes to the marketing concepts (customer buying, marketing strategy, call centers) that have been brought about because of electronic customer relationship management. The paper illustrates several examples of how eCRM has altered the marketing concept.

The second paper by Chai and Pavlou conducts an empirical study investigating whether cultural dissimilarities really matter in the context of growing a virtual business. The results suggest that culture plays moderating role on E-commerce adoption.

Roussinov and Zhao, in their paper build a prototype eCRM to explore and improve communication effectiveness and efficiency in a university environment. The results suggest that a text clustering technique can aid in analyzing customer messages, thus providing a valuable source of customer information.

Webb and Webb present a conceptual model and an instrument to measure Web site quality. A factor analysis of the data suggests that there are three key quality factors that customers are concerned about (navigation, relevant representation, and accuracy). These factors are further discussed in the paper.

The last paper by White and Daniel was awarded the "best overall paper" at the Business Information Technology (BIT) Conference held at Manchester Metropolitan University in November 2002. This paper explores the e-marketplace dyadic buyer-supplier relationships in the health sector. The results suggest that the adoption of an e-marketplace reduces the number of suppliers used, but more importantly, expands the relationship between and blurs the boundaries of the parties.

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E-relationship marketing: changes in traditional marketing as an outcome of electronic customer relationship management

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Keywords

Customer relations, Electronic commerce, Relationship marketing

Abstract

Marketing concepts and definitions have remained relatively unchanged until recently. Electronic customer relationship management (eCRM) has forced marketing managers to reevaluate how, when and to what extent they interact with their customers. This paper is focused on the role of specific marketing concepts and how eCRM has enhanced or altered each concept. Every topic discussed is illustrated with current business examples. Several examples from the business trade press are used to illustrate the success an organization can achieve when using eCRM to enhance marketing skills.

Introduction

Electronic customer relationship management (eCRM) is the latest technique companies are using to increase and enhance their marketing skills and capabilities. Traditional definitions of marketing according to Stanton *et al.* (1994) include a philosophy or orientation for the whole business – defining the primary goal of everyone in the organization or the identification and creation sustainable competitive advantage. This paper explores how eCRM expands these traditional definitions of the marketing concepts and enables a company to meet their internal marketing objectives. The paper also expands on the basic research issue for markets on how best to integrate eCRM to be both effective and efficient for an organization (Romano and Fjermestad, 2002, 2003). The following key topics are discussed: customer buying, marketing strategies, and the evolution of customer call centers to a customer e-contact center in relation to an eCRM implementation. In addition, marketing strategies, forming a strategic alliance, customer strategy and product differentiation will be discussed in terms of an eCRM implementation.

Customer buying behavior

A customer is an individual or organization that makes a purchase decision. The purchase decision is based on the customer satisfying their wants and needs (Stanton *et al.*, 1994). This gives a challenge to the marketing manager. According to Allen and Fjermestad (2001), the marketing manager must be able to show, communicate and demonstrate how their product can satisfy the wants and needs of a customer.

When purchasing a product the customer will either make a high or low involvement decision. A high involvement purchase will occur when a consumer is dissatisfied with the quantity or quality of information about the purchase situation and decides to actively collect, and evaluate more products. A low involvement purchase is when a customer is comfortable with the information and alternatives readily available. A low involvement purchase is usually related with impulse buying (Stanton *et al.*, 1994). An objective of the marketing manager (and sales representatives) is to be able to relate and react to both types of purchase decisions. Customer relationship management

(CRM) tools can help a sales representative and marketing manger relate to both types of purchasers.

E.piphany (Maselli, 2002) developed a technology that can deliver information to the sales representative about the customer. This information is presented before the customer is contacted in order to help the sales representative prepare for the sale. The software will pull all relevant product, sales data and customer information from one or multiple sources in the organization. This information is available via the Web, e-mail and/or by mobile access. By providing information about a product before a customer requests it, the customer may be converted from a high involvement to a low involvement purchaser.

In addition to influencing the purchasing involvement, eCRM can also help create customer profiles and customized products. Traditionally customer profiles were either demographic or behavior-based. A demographic profile may have included marital status, if customer had children, where the customer lived and what magazines he/she liked to read. A behavior-based profile may describe the number of times a customer clicked a particular Web site because it is more focused around the "action" of the customer (Novo, 2003). eCRM can add "intelligence" to the customer profiles and can help deploy customized products.

The health care industry is one taking advantage of eCRM customer profile technology and customizable products. Humana, one of the largest health insurers is using eCRM technology to create health plans for its patients (Berinato, 2002). The goal of the new system is to stabilize the cost of healthcare. The patient will no longer have money deducted from their paychecks and instead will be given an allowance each year. The allowance is determined by asking the patient a series of health and medical questions through an online application. Once the patient has completed the questionnaire a series of health plans will be presented to the patient. Each health plan will have a specific allowance amount. A healthy patient will have a lower allowance than a patient on chronic medication. The eCRM system also allows patients to see the cost of brand name versus generic drugs, the cost of doctors and emergency room visits. Since the patients have an allowance and know the cost of an emergency room, unnecessary trips to the emergency room may be avoided (Berinato, 2002). By creating the customer profiles with an eCRM the patient and the company may save time and cost saving.

Along with cost savings eCRM solutions can help companies add to the bottom line. The traditional way of judging success of a Web site is to count the number of visitors to a page. Additionally, many companies critique their Web site by the number hits and page views within a specific time frame. However, given that only two percent of Web visitors will actually make a purchase, companies should spend more time tracking why Web visitors abandon their purchase or shopping cart (Roussel-Dupre, 2002). A company can use eCRM to identify an Internet niche to increase online purchases and reduce abandoned purchases. For example Ritz Interactive Inc. (Roussel-Dupre, 2002) has identified a niche selling digital cameras online. Photography is one of Ritz Interactives core e-commerce markets. Through research, the company realized that the 25 percent of all digital cameras are purchased online. This is not surprising considering the demographic similarities of the digital camera consumer and the online shoppers. Ritz Interactive may even be able to expand this niche by creating customer profiles and allowing them to customize their digital camera.

When a company has a highly customized product it requires extreme care and focus when discussing the product specifications and taking a customer order. Paper orders can become misplaced and information can be omitted. Moving the ordering process to an online system will give the customer and customer service representatives a better chance of succeeding. Invacare, a home medical equipment company implemented an eCRM solution to help the marketing, sales and customer service representatives (McCall, 2002a). The system implemented did not require customers to download any software to their desktops and it was integrated into Invacare's existing legacy systems. This allowed for a customer to log onto the Web site and customize their medical equipment (for example a wheel chair). The Web site would alert a customer when information was missing or was incorrect for the particular item being customized. Once the information has been entered the customer is presented the price and the ability to purchase the item. The customer can log back onto the Web site to view the status of their order. While viewing the status of their order, Invacare presents the customer with items similar to their purchase based on the existing customer profile. This capability is available because of the new eCRM solution. The eCRM is thus allowing sales representatives to view customer information from anywhere and has freed up customer service representatives to focus on obtaining new customers.

Marketing strategy

Having detailed customer information from an eCRM system allows a company to predict the

kind of products that a customer is likely to buy as well as the timing of the purchases. Customer information collected is useful for developing an effective marketing strategy. A strategy includes an integrated view of the customer, customer decision analytic and optimized customer interactions (Gaines, 2002). A company may choose a number of marketing strategies including: strategic alliance, customer focused strategy and product differentiation.

Strategic alliance

Forming of a strategic alliance is a tactic a company can use when developing an effective marketing strategy. A strategic alliance is an agreement between two or more individuals or entities stating that the involved parties will act in a certain way in order to achieve a common goal. Strategic alliances usually make sense when the parties involved have complementary strengths. A successful strategic alliance and a successful eCRM implementation will have benefits for the customer and the company.

Cytyc Corp is an example of this success (McCall, 2002b). The company develops manufacturers and sells products for medical diagnostic applications. The company distributes its products globally to medical laboratories that in turn sell its products to healthcare professionals. The company had grown from a sales force of 75 sales representatives to over 150, a year later. When the company employed only 75 sales representatives all collected data were written down on notepaper and entered into the database by administrative assistants. Since the sales representatives were meeting with physicians with limited time, their notes were often difficult to read and incomplete. It could take up to the three weeks for the data to be corrected, uploaded and reports provided to management. Cytyc Corp implemented an eCRM solution to improve this process (McCall, 2002b).

The eCRM solution consisted of four major pieces, a centralized application that was responsible for linking the new software to the existing ERP system, an application loaded on all sales representatives' laptops, synchronization software and reporting software. Additionally, the eCRM solution implemented has Web component which will allow for information access anywhere in the Web. This solution allows the company to save $200,000 a year in data entry costs and has allowed the company to focus on obtaining a strategic alliance. The eCRM solution has allowed Cytyc to capture the different testing physicians are doing, which types of test are covered by insurance companies and what objections physicians may have toward new tests.

This information can now be presented a potential strategic alliance for developing product-marketing partnerships. These partnerships are essential for Cytyc to maintain its growth.

Customer strategy

Cytyc's marketing problem was organizing its internal information and presenting it to potential business partners. Customers have this same type of problem when trying to look through the large amounts of information provided by competing products/services. An effective marketing strategy can be achieved by developing an effective eCRM customer strategy (Rigby et al., 2002). The idea behind developing a customer focused strategy is not to mold the customer to the company's goals but to listen to the customer and try to create opportunities beneficial to both. It is important to offer customers what they are currently demanding and anticipate what the customer is likely to demand in the future. This can be achieved by providing multiple access channels for customers to use such as traditional e-mail, telephone, fax and preparing for future channels such as wireless applications. A business eCRM guide[1] published a set of headlines that companies should take to heart "Offer solutions, not headaches…business should seek ways to decrease the 'work' of the household, such as empowering customer services agents to make it right, right away and updating customers on sales and promotions via their preferred communication method". In other words, give customer a choice not to receive e-mails if they do not want them, allow a customer to choose the delivery method of information via phone or fax and offer a customer the means to consistently update and change how and when they are contacted by the company.

In the short to medium term, this information helps an organization create more effective and focused marketing/sales campaigns designed to attract the desired customer audience. Advantages are gained when accurate customer information is available real-time. This is called analytical CRM (Dyche, 2001; Rong et al., 2001). Analytical CRM is a combination of a data warehouse or data mart integrated with business intelligence analytical systems (online analytical processing – OLAP). The objective of such a system is to give an organization competitive intelligence, the power to tailor marketing, for example, efforts to single-customer specifics, and the data-to-action speed to realize value from efforts faster than ever. Information is pulled from all systems and organized into a way that is easy to see what products and services are the right ones to offer to a customer, how the organization is doing or perceived by a particular customer and which

customers would prefer to end the relationship (Gaines, 2002).

The information retrieved in OLAP can be used with eCRM by allowing for more targeted campaigns and tracking of campaign effectiveness. Launching a new product in the market requires an effective marketing campaign and complete understanding of the company customers. In the 1970s J.M. Smucker Company wanted to implement a new product as part of their product mix expansion strategy. Adding a new product to an existing product mix is often necessary to compete with competitors and keep customers satisfied. The Smucker Company (Wells, 2002) tried this approach unsuccessfully by adding pickles to their existing product lines. This product was launched without complete analysis of the existing customer base. Smuckers' customers related to products in the cooking oils, fruit, peanuts and sweeteners. Pickles were not sweet and thus they were not embraced by their existing customers. eCRM may have helped Smuckers implement a successful product mix expansion and increase customer satisfaction. CRM can identify which products customers embrace and which new ones will be successful. Before an expansion, addition or removal of a product line the management team must first understand their customers. Smuckers now understands this and is adding two new product lines, Jif Peanut Butter and Crisco. Both of these product lines were carefully evaluated for acceptance by existing customers and were chosen based on their established reputation. Smuckers has implemented the tools necessary for a successful product mix expansion and increased customer satisfaction.

Product differentiation

As discussed above in the Smuckers example, today's customers are faced with choosing between different product alternatives. Customers use information for their purchase decision from two sources: commercial and social. Commercial information is media advertising, store clerks, telemarketing and direct mail. Social information can be found in the form of word-of-mouth communication. Word-of-mouth communication occurs on daily basis between family, friends, acquaintances and co-workers. By improving customer service, social information for a product may become more positive. If a product is hard to differentiate in the market place it is more important to have positive social information (Stanton et al., 1994).

FedEx, UPS and US Postal Service have a product that is hard differentiate (Maselli and Colkin, 2002). However, FedEx and UPS have taken a slight lead over the US Postal Service using eCRM to help with product differentiation. In 1998, FedEx scored 80 percent in customer satisfaction and UPS and US Postal Service scored 77 and 75 percent, respectively. The close gap has since been widened due to increased eCRM applications implemented at FedEx and UPS. FedEx has implemented a system that will track every part of the transaction. The data are combined into a database and evaluated on a daily basis. Customers can communicate to FedEx via the Web or the call center and let them know if the package was damaged, on time and if the billing was correct. FedEx tries to maintain the same high level of customer experience online and in the call center. UPS has also tried to expand the customer perception. Every application implemented at UPS must have a documented benefit to the customer, improve customer service and decrease cost over a period of time. The company has implemented an online service for customers to track packages and installed an automated voice response system. The company has not forgotten the importance of "live customer service representative" and has trained their call center representatives in the latest technology. The efforts by FedEx and UPS have paid off with increased customer satisfaction. In 2002, FedEx has an 82 percent customer satisfaction rating and UPS had an 80 percent rating. According to Maselli and Colkin (2002), the US Postal Service has lost customer satisfaction over the years and is at 73 percent. FedEx and UPS continue to learn the benefits of treating every customer the right way.

Call centers/e-contact centers

Treating customer the right way, every time is the goal of many customer service representatives in call centers. With the evolution of the Internet, traditional call centers have evolved into an e-contact center. The purpose of an e-contact center is to provide a personal customer service experience that is individualized to each customer's needs and questions (Deitel et al., 2001). An e-contact center is made up of multimedia channels including a call center, Web site, online chat rooms and e-mail services. The traditional brick and mortar call centers are "becoming a thing of the past". Customers who are interacting with a company on the Internet prefer to get their answers on the Internet. A Web enabled contact center can provide information via instant messages to customers. Customers no longer have to remain on hold waiting for a representative to take their call. Companies need to integrate all customer databases to meet the needs of the customers who send an e-mail today

but calls tomorrow. Using the Web will allow customers to see their complete account information online, where in previous time only customer service representatives had the information. The key to a successful e-contact center is integration. An integrated call center allows companies to communicate with the customer more effectively and in the manner each individual customer prefers (Mauriello, 2002).

Best Buy has implemented an e-contact center (Cohn, 2002). The system implemented can digitally record calls, enables administrators to evaluate how agents were responding, provide training when necessary, and record how e-mails were answered and how the e-mail was structured to the customer. Best Buy can track the quality and consistency of customer service delivered by recording the way a customer service representative handles a customer. It is a way of making sure a "standard response" is not told or sent to every customer. Best Buy wants to ensure a customer question is directly answered regardless of the media channel. The new e-contact center also allows for the supervisors to rate/grade the representatives. Representatives who score low have the appropriate training sent directly to their desktops. Best Buy now focuses their attention on the customer and answering their questions.

Conclusion

This paper has shown how eCRM can add to traditional marketing concepts. eCRM is not here to change the marketing but instead to enhance it. As demonstrated above established companies have found more success by embracing eCRM. When companies understand customer buying behavior they can enjoy cost savings and increased customer loyalty as shown with Humana (Berinato, 2002). A strategic alliance can be formed to leverage one company's existing marketing experience and increase sales of the other. Identifying products customers want is the first step of product mix expansion, new product launches and product differentiation. Finally, call centers are evolving into e-contact centers with the help of eCRM. Marketing managers have a wealth of eCRM tools available to them to help them achieve their goals and objectives. Together eCRM and marketing managers can successfully implement new products, launch new marketing campaigns, and satisfy customer needs and wants.

Note

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From "ancient" to "modern": a cross-cultural investigation of electronic commerce adoption in Greece and the United States

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Abstract

Globalization and the ubiquitous nature of the Internet facilitate e-commerce activities across nations. An empirical study was conducted using data from Greek and US consumers in order to obtain a better understanding of cross-cultural e-commerce adoption. The results give support for the proposed hypotheses, emphasizing the moderating role of cultural differences on consumer e-commerce adoption. The unique contributions of this paper are three fold. First, we introduce Hofstede's cultural dimension of uncertainty avoidance to the study of cross-cultural e-commerce adoption model. Second, we apply the theory of planned behavior perspective to capture behavioral intentions to transact online in two dissimilar countries – Greece and the US. Finally, the paper discusses several insights from this exploratory study that enrich the cross-cultural e-commerce literature.

Introduction

Access to the Internet gives consumers new power because of the relative ease of information gathering and brand switching (Shapiro and Varian, 1999). As a result, Web-based product and service providers recognize that a customer focus is critical to their marketing strategies (Yu, 2001). Although some have maintained that global tastes have become homogenized through the ubiquity of McDonalds hamburgers and Toyota cars (Levitt, 1983), others have persuasively argued that many international companies have a customer base desirous of customization (Bartlett and Ghoshal, 1989). Demands for worldwide local responsiveness translate into pressures for a personalized customer focus.

To account for the increasing globalization of e-commerce, this research includes an examination of the cultural dimension by using Hofstede's (1980) categorization of national societies. At both the national and international levels, the pressing need for customer focus translates into a requirement for understanding these important unanswered questions:

(1) What factors lead customers to online transactions?
(2) How can Web businesses influence customers to transact with them?
(3) How does national culture influence customer intentions to transact with Web firms?

The overall purpose of this paper is to provide a theoretical justification and an empirical investigation into these questions.

The US and Greece were chosen for this study because they represent clearly divergent positions on the important cultural dimension of uncertainty avoidance. The US is moderate to low on that measure, while Greece's score is the highest (X) for any country measured. This distinct cultural dimension is suggested to moderate consumers' intentions to adopt e-commerce.

Conceptual development

Cultural dimensions

Culture is the man-made part of the human environment (Herskovits, 1955). Culture has been likened to a giant, extraordinarily complex, subtle computer whose programs guide the actions and responses of human beings in every walk of life. Cultural programs will not work if crucial steps are omitted, which happens when people unconsciously apply their own rules to another system. A widely used definition of culture is derived from Dutch psychologist

Hofstede (1991): "Every person carries within him or herself patterns of thinking, feeling and potential acting which were learned throughout their lifetime" (p. 4). Using the analogy of the way in which computers are programmed, Hofstede calls such patterns mental programs, or "software of the mind". Mental programs vary as much as the social environment in which they were acquired.

Hofstede's (1980) cultural dimensions serve as the most influential culture theory among social science research (Nokata and Sivakumar, 2001). In addition, Hofstede's cultural framework has also received strong empirical support (Sondergaard, 1994). The framework was generated through the most extensive examination of cross-national values ever undertaken, with 116,000 respondents and across 40 countries. The results were consistent with findings in 38 other studies (Nokata and Sivakumar, 2001).

Hofstede (1980, 2001) described a number of dimensions that distinguish cultures. Among these are masculinity, power distance, and long-term orientation. A further dimension is uncertainty avoidance, which refers to how much people feel threatened by ambiguity, as well as the felt importance of rules and standards. People with an orientation low on uncertainty avoidance prefer situations that are free and not bound by rules and regulations. Other studies have identified a similar dimension, showing its robustness (Chinese Cultural Connection, 1987; Hofstede and Bond, 1988). This cultural difference is examined in the proposed e-commerce adoption model as a key moderator. In doing so, this paper represents one of the first efforts at applying Hofstede's work into the study of e-commerce adoption.

The theory of planned behavior

The theory of planned behavior (TPB) is a well-established general theory of social psychology, which asserts that specific salient beliefs influence behavioral perceptions and subsequent actual behavior (Ajzen, 1985, 1988, 1991). The TPB extends the theory of reasoned action (Fishbein and Ajzen, 1975) to account for conditions where individuals do not have full control over the situation (Madden *et al.*, 1992). The TPB offers promise of providing an overall conceptual guide to e-commerce adoption behavior. The TPB posits that attitude, subjective norm, and perceived behavioral control explain intention to engage in a behavior, and that intention to engage in a behavior explains that behavior. Following TPB, there are three types of beliefs in the TPB that impact three perceptual constructs: behavioral beliefs that influence attitudes, normative beliefs that affect subjective norm, and control beliefs that shape perceived behavioral control. The specific

aim of this research is to predict consumer adoption of e-commerce by employing the TPB. For this study, consumer intention to transact in e-commerce is proposed as the behavioral intention to engage in online transactions with Web retailers. Finally, cultural factors are considered in our proposed understanding of e-commerce adoption, as necessitated by the global reach of the Internet and subtle differences among national cultures.

According to the TPB, attitude towards a transaction is defined as the overall evaluation of the desirability of a potential behavior. In their decomposed TPB (DTPB), Taylor and Todd (1995) describe the construct as the generalized attitudinal belief that a behavior will lead to a particular outcome. Subjective norm is the influence of a person's normative beliefs that others approve or disapprove a particular behavior (Ajzen, 1991). For the present study, subjective norm is the influence from consumers' normative belief that their behavior is accepted and promoted by their circle of influence. In other words, consumers may believe that their family and peers would favor certain behaviors, and this belief tends to influence their intentions and behavior. Perceived behavioral control refers to consumer perceptions of whether a behavioral act is within their control (Ajzen, 1991). As with attitude and subjective norm, the TPB posits that perceived behavior control tends to influence intentional behavior, which is that part of a person's activity that is under conscious control.

Figure 1 presents the proposed research model. Following the TPB, attitude toward the transaction, subjective norm and perceived behavioral control directly influence purchase intention. These relationships are moderated by the cultural difference of uncertainty avoidance.

The dependent variable is purchase intention. Following Zwass (1998), intention to transact online is defined as the consumer's objective to engage in an electronic exchange relationship with a Web retailer, such as sharing business information, maintaining business relationships, and conducting business transactions. e-Commerce adoption essentially necessitates that the consumer uses a Web retailer's Web site to complete a product purchase.

Perceived behavioral control

Perceived behavioral control is a general construct dealing with consumer perceptions of whether an action is within their control (Ajzen, 1991). Research shows support for the role of perceived behavioral control on behavioral intention. For example, Mathieson (1991) shows that behavioral control influences intention to use an information

Figure 1 The conceptual model
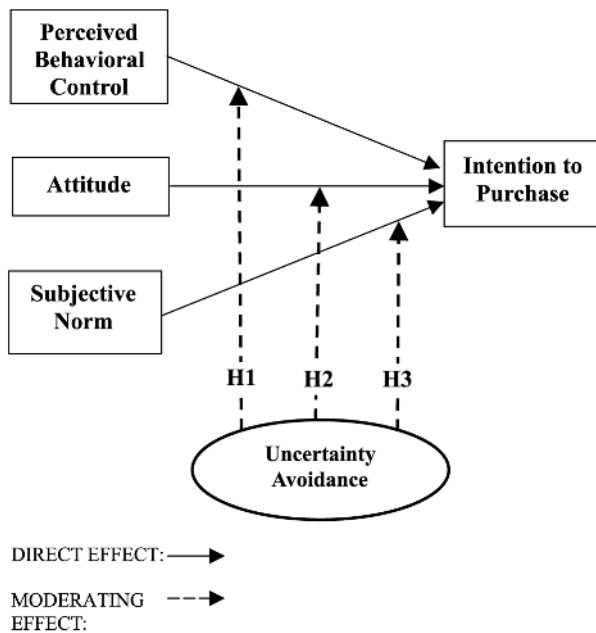
system. A positive relationship between control and intentions is also found in Taylor and Todd (1995) who examine users in a computer resources center. Behavioral control should have a positive effect on online transaction intention. Perception of control would facilitate people's engagement in seeking relevant purchasing information since the consumer has the opportunity and resources to manage such behavioral activities. In addition, the consumer would not have fears of opportunistic behavior from a Web retailer. Thus, we expect a positive relationship between perceived behavior control and intention to purchase online.

Uncertainty avoidance represents the extent to which a society's members wish to avoid uncertain and ambiguous situations (Hofstede, 1980, 2001). Cultures high on uncertainty avoidance prefer structured situations (Singh, 1990) and view human behavior as predictable (Kale and McIntyre, 1991). Cultures low on uncertainty avoidance are relatively comfortable with situations lacking in structure and see human behavior as unpredictable (Gundykunst, 1997). Thus, low uncertainty avoidance cultures would have members who tend to take for granted the existence of facilitating conditions for online transactions. Thus,

H1. The relationship between perceived behavior control and purchase intention is weaker in a society characterized by high uncertainty avoidance, compared to one low in uncertainty avoidance.

Attitude

Attitude is defined as the overall evaluation of the desirability of a potential transaction with a specific Web retailer. Attitude has been proposed to influence behavioral intentions in multiple theories, such as the TPB (Ajzen, 1991) and the theory of reasoned action (Fishbein and Ajzen, 1975). The theoretical predictions of these theories have received substantial empirical support in multiple contexts. Hence, applied to the online consumer behavior context of this study, favorable attitude toward a Web retailer is likely to encourage consumers to receive information, to facilitate the act of providing information, and also to conduct monetary transactions with a given Web retailer. Attitude is an overall evaluation of a Web retailer's characteristics; hence, it is likely to influence all transaction activities with a retailer. Therefore, favorable attitude is expected to facilitate online transactions and reduce barriers to the adoption of e-commerce. Thus, we expect a positive relationship between attitude and intention to purchase online.

Similar to the argument about perceived behavior control, countries with high uncertainty avoidance, such as Greece dislike uncertain situations and prefer to act only under known conditions. Countries low on uncertainty avoidance, such as the US, are relatively comfortable with uncertainty care less about knowing all the consequences of their intentions. Thus, people in low uncertainty avoidance cultures would tend to have a correspondence between their attitude about e-commerce their intention to engage in it. Thus,

H2. The relationship between attitude and purchase intention is weaker in a society characterized by high uncertainty avoidance, compared to one low in uncertainty avoidance.

Subjective Norm

Beliefs arising from social pressure are termed normative (Ajzen, 1991). Subjective norm is the influence of a person's normative beliefs that others approve or disapprove of performing a particular behavior. For the TPB, people's intentions to perform a particular action are a function of subjective norm, or their perception that important others think they ought to do so. In the present context, subjective norm is the influence from consumers' normative belief that the behavior is accepted, encouraged, and promoted by their circle of influence.

Research literature shows support for the role of subjective norm on system usage. For example, in a cross-sectional comparison of pre- and post-adoption of Information Technology,

Karahanna *et al.* (1999) found that top management, supervisors, and peers significantly influenced adoption intention for both potential technology adopters and actual users. In addition, they found that MIS staff and friends were important influences for potential adopters, while specialists played a significant role for actual users. Chiasson and Lovato (2001) report that subjective norm is a significant antecedent of IS adoption intention and Morris and Venkatesh (2000) found that IS workers were strongly influenced by subjective norm. Thus, we expect a positive relationship between subjective norm and intention to purchase online.

Similar to the arguments about perceived behavior control and attitude, it is expected that people in countries with low uncertainty avoidance, such as the US, would have a correspondence between their subjective norm feelings of external influence and their intention to transact online. Relative to high uncertainty avoidance cultures, such as Greece, such people would not be bothered by doubts about whether they ought to engage in online shopping just because important others perceive that they ought to. Thus,

H3. The relationship between subjective norm and purchase intention is weaker in a society characterized by high uncertainty avoidance, compared to one low in uncertainty avoidance.

Research method

This study used an experiential survey method, in which voluntary participants were asked to rate their responses regarding a self-selected Web retailer. The survey instrument was administered to randomly selected online consumers from the US and Greece. For the US, out of the 2,000 initial participants, 202 e-mails were returned undeliverable, and following two e-mail reminders, 181 responses were obtained, resulting in an effective response rate of 10 percent. For Greece, out of 1,800 e-mails sent out, 312 were undeliverable, and 70 final responses resulted, for a rate of 5 percent.

Measure development

The principal constructs were developed based on existing measures where possible, or they were adapted from similar scales. The intention to transact measure was based on scales measuring intentions to use a system (Venkatesh and Davis, 2000) and had five items. Measures for attitude, perceived behavioral control, and subjective norm each had three items and were based on the empirical studies of Taylor and Todd (1995),

Mathieson (1991), and Miniard and Cohen (1981). Although most items were based on previous empirical studies, the actual scales were developed to capture the context of this study. The instrument was pretested by personally administering it to multiple consumers varying in age, sex, and ethnic origin to verify its appropriateness and comprehensiveness. None of these phases revealed any major problems, but the questionnaire was progressively refined, simplified, and shortened. The questionnaire was translated from English to Greek by a bilingual expert, and back from Greek to English, to ensure consistency.

Measure validation was initially examined for reliability by computing Cronbach's α coefficient for each construct. As shown in Table I, all measures have high levels of reliability, both for Greece and the US, all above the recommended 0.7 levels. Discriminant and convergent validity of the scales was examined using exploratory principal component factor analysis with a Varimax rotation. All items loaded significantly on their hypothesized factors, and using the 0.40 rule-of-thumb, all cross-loadings were low.

Results

Table I reports the correlation matrix, means, and standard deviations of the study's principal constructs for the combined sample.

Hypothesis testing

In order to examine the proposed hypotheses, a set of two linear regressions was employed. In each case, all variables in a block were entered in a single step. As shown in Table II, results for the combination of both countries broadly support the role of the TPB in explaining consumer adoption of e-commerce. Tables III and IV give results for the US and Greece, respectively. Following is an explanation of the hypothesis findings based on these tables.

H1 argued that the relationship between perceived behavior control and purchase intention is weaker in a society characterized by high

Table I Correlation matrix of principal constructs

	Intent	Norm	Control	Attitude
Intent	1.000	0.506**	0.476**	0.545**
Norm		1.000	0.438**	0.450**
Control			1.000	0.574**
Attitude				1.000
Alpha	0.8619	0.9227	0.9257	0.9253

Note: **Corresponds to $p < 0.01$

Table II Results of regression analysis of the research model for both countries

Model	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	T	Sig.
1 (Constant)	6.888	2.011		3.426	0.001
Attitude	0.632	0.134	0.319	4.724	0.000
Control	0.297	0.110	0.181	2.698	0.008
Norm	0.516	0.112	0.284	4.601	0.000

Note: Dependent Variable: Intent

Table III Results of regression analysis of the research model for the US

Model	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	t	Sig.
1 (Constant)	4.172	2.337		1.785	0.076
Attitude	0.597	0.147	0.304	4.053	0.000
Control	0.314	0.120	0.196	2.624	0.010
Norm	0.712	0.144	0.353	4.938	0.000

Note: Dependent Variable: Intent

Table IV Results of regression analysis of the research model for Greece

Model	Unstandardized coefficients		Standardized coefficients		
	B	Std. error	Beta	t	Sig.
1 (Constant)	11.381	4.098		2.777	0.007
Attitude	0.711	0.308	0.339	2.309	0.024
Control	0.125	0.262	0.071	0.476	0.636
Norm	0.305	0.192	0.192	1.590	0.117

Note: Dependent Variable: Intent

uncertainty avoidance, compared to one low in uncertainty avoidance. *H1* was supported. For the US, the relationship was statistically significant ($B = 0.314$, $p < 0.01$), but for Greece, the relationship was not statistically significant ($B = 0.125$, $p > 0.01$), as shown in Tables III and IV.

According to *H2*, The relationship between attitude and purchase intention is weaker in a society characterized by high uncertainty avoidance, compared to one low in uncertainty avoidance. *H2* was not supported, as shown by a statistically significant relationship for both countries (US: $B = 0.597$, $p < 0.05$; Greece: $B = 0.711$, $p < 0.05$), as shown in Tables III and IV.

Finally, *H3* maintained that the relationship between subjective norm and purchase intention is weaker in a society characterized by high uncertainty avoidance, compared to one low in uncertainty avoidance. *H3* was supported. For the US, the relationship was statistically significant ($B = 0.712$, $p < 0.01$), but for Greece, the relationship was not statistically significant ($B = 0.305$, $p > 0.1$), as shown in Tables III and IV.

Discussion

Central to e-commerce is a clear view of the process that leads to online transactions. Knowing the important determinants of customers' intention to transact online would allow the targeting of those determinants to better serve customer needs. This study has extended our understanding of psychological aspects of cross-cultural e-commerce by showing that global customers are different and must be understood in the context of their own culture. The key to successful e-commerce is to understand the sources of customer intention to transact. Finding these sources was the aim of the present study.

Validating the TPB in an e-commerce context, the relationship between attitude and purchase intention is found to be significant for the both countries, when taken together. Subjective norm was also found to be related to purchase intentions, suggesting that it is also an e-commerce determinant. These results are consistent with the findings of a China-US cross-cultural e-Commerce study (Chai and Pavlou, 2002). Perceived behavior control was also found to be a significant predictor of purchase intention in the entire sample.

The moderating influence of uncertainty avoidance was found to exist with respect to perceived behavior control and for subjective norm, but not for attitude. As hypothesized earlier, our findings suggest that a culture with high uncertainty avoidance would exhibit a weaker norm-intention relationship and a weaker control-intention relationship. These findings call for attention in understanding online consumers' preferences based on cultural, rather than, economic criteria.

Perceived behavioral control was a significant determinant of e-commerce transaction intention in both countries, and the expected weaker effect of uncertainty avoidance on the relationship between control and purchase intention for Greece was clearly evident in this sample. Another expected finding relates to uncertainty avoidance and its significant impact on the association between subjective norm and purchase intention for the US, but not for Greece.

Unexpectedly, we found no moderating influence for uncertainty avoidance with respect to the connection between attitude and intention. This could perhaps be explained by the age difference between US and Greece samples. For example, the average age for US consumer sample was 37, while, that for the Greece sample was 27. Age disparity could offer a potential understanding for the lack of cultural effect on this relationship. Another possibility is that hypotheses for this study

were developed largely from the e-Commerce literature, and an examination of online consumer behavior in the marketing research might allow for more detailed predictions.

In sum, the role of uncertainty avoidance, while not found in every instance, is still a strong moderator in the proposed e-commerce adoption model, emphasizing the role of cultural aspects in e-commerce research.

Theoretical and managerial implications

This study attempts to set the stage for developing new theory by grounding an important cultural dimension, uncertainty avoidance, in a well-accepted model, the theory of planned behavior, and then making applications in a cross-cultural context. Empirical results validate the long-standing notion of important cultural differences between Greece and the US and show that those differences extend to the e-commerce context. Results of this research additionally suggest that different research models of e-commerce are appropriate for different cultural contexts (Malhotra and McCort, 2001).

e-Commerce is gradually attaining a global scope. A common mistake in practice is to assume that all consumer behavior is similar to that of the US (Samli, 1995). Although the majority of online shoppers are in the US, other countries are steadily entering the e-commerce realm, and online shopping is rapidly acquiring an international presence. This research has demonstrated the importance of distinguishing e-commerce adoption on the basis of cultural differences. Managers of online shopping companies could use the preliminary insights developed here to modify their approaches, depending on the culture they are targeting. For example, managers attempting to penetrate the Greek market should focus on creating and fostering a secure online transactions image. The Greek culture, similar to that of the US, exhibits a strong relationship between attitude and purchase intention. Companies should therefore make it a business priority to establish a strong local identity and presence in the local country.

Limitations and suggestions for future research

Several limitations of this research should be mentioned, which call for future research. First, much of e-commerce behavior might occur because of habituation as opposed to intentional behavior (Limayem et al., 2001). This research did not account for habitual purchase behavior. For example, for many people, online shopping is gradually becoming a habit as opposed to being driven by thoughtful deliberation. Therefore,

examining this factor may reveal interesting aspects of e-commerce adoption.

Future research should aim to retain and enhance the predictive power of the proposed model, while eliminating unnecessary variables that compromise its parsimony. For example, long-term orientation, which Hofstede and Bond (1988) later combined into his research, could also be added to the model as another cultural moderator.

Future research could also take into consideration the interaction effects of other cultural dimensions, providing a deeper and richer understanding of e-commerce in the global setting by conducting studies in multiple countries with different degrees of cultural variation across Hofstede's dimensions. Other aspects of interest would be demographic characteristics of consumers, given the average age for the US consumer sample was 37, while, that for the Greece sample was 27. Finally, the issue of small sample size, due to low response rate could also be dealt with in future research. The fact that the response rates for the two countries were different (10 percent for the US vs 5 percent for Greece) might also have impacted the results and should be addressed with further data.

Conclusion

This study contributes to our understanding of global e-commerce. A main contribution is that a set of interrelationships between important factors that tend to be associated with transaction intentions in e-commerce was specified, justified, and empirically validated. Another important contribution of this research is the placement of fundamentally important variables – attitude, subjective norm, and perceived behavioral control as determinants of e-commerce adoption, drawing from a well-established model of social psychology. Most importantly was the added cultural aspect, that of uncertainty avoidance, which showed significant moderation in the proposed model, reflecting the growing importance of globalization in e-commerce.

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Text clustering and summary techniques for CRM message management

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Abstract

One of customer relationship management (CRM) activities involves soliciting customer feedback on product and service quality and the resolution of customer complaints. Inevitably, companies must deal with large number of CRM messages from their customers either through e-mails or from work logs. Going through those messages is an important but tedious task for managers or CRM specialists in order to make strategic plans on where to place the resources to achieve better CRM results. In this paper, we present a methodology for making sense out of CRM messages based on text clustering and summary techniques. The unique features of CRM messages are the short message length and frequent availability of correlated CRM ratings. We propose several novel techniques including organizational concept space, Web mining of similarity relationships between concepts, and correlated analysis of text and ratings. We have tested the basic concepts and techniques of CRM Sense Maker in a business setting where customer surveys are used to set strategic directions in customer services.

1. Introduction

According to a recent book on customer relationship management (CRM) (Swift, 2001), CRM is "an enterprise approach to understanding and influencing customer behavior thorough meaningful communications in order to improve customer acquisition, customer retention, customer loyalty, and customer profitability." The challenge is to continue attracting new and profitable customers whilst forming ever-tighter bonds with existing ones, thus creating a profitable customer base. One of the important aspects of customer retention is to address their problems and queries timely and effectively.

Companies are spending a large amount on service management (SM) and complaint management (CM) systems in order to understand and evaluate which customer issues to act on, and in what order. According to CRMDaily.com, worldwide CRM spending reached US$13.7 billion by the end of 2002 based on a report by the Aberdeen Group and should be close to $20 billion by 2005 (Morphy, 2002). As such, CRM is a strategic matter, and the company must decide how to allocate limited CRM resources for the maximum impact on overall customer satisfaction.

Since customer support inquiries often provide critical information on product defects or service deficiencies companies need automated methods for tracking customer complaints and actions taken to close the gap with the customer. Modern CRM systems provide an integrated, structured connection between customer support centers and back-end engineering, production, or product management organizations (www.remedy.com). It helps companies to capture and store information on customer issues, ideas, and suggestions, as well as to assign and route them to the appropriate groups.

CRM managers must frequently study customer survey data, customer complaint data, and other forms of customer sentiment messages in the form of text. Because the number of those CRM messages is frequently in the hundreds or thousands, reading and summarizing those messages is an overwhelming task. Consequently, there is a great need for an effective tool to assist CRM managers to analyze thousands of customer messages in order to discover recurrent issues and problems based on customers' feedback. This problem falls into a more general problem of information overload in the knowledge management context and even a more general context of computer mediated communication (CMC) (Hiltz and Turoff, 1985; Gallupe and Cooper, 1993).

Within CRM systems, the messages are frequently stored in a digital format. This makes it possible to utilize past research ideas and tools in CMC towards managing CRM messages. The general CMC approach to information overload reduction is to impose structure on the data (Hiltz and Turoff, 1985). Much work in this direction has been done within the group decision support systems context, specifically in automated summarization of meeting messages, for example by representing them with a list of most representative topics (Chen *et al.*, 1994), or using concept maps (Orwig *et al.*, 1997), or clustering messages into semantically homogeneous groups (Roussinov and Chen, 1999). The common belief behind those approaches is that automated processing techniques can reduce the cognitive load of meeting participants even if manual post-processing is still required.

While many text-processing techniques exist in the literature and laboratories, few CRM tools have incorporated them in the real world. The main reason is that the existing techniques are not easy to use by an average manager.

In this paper, we address the ability of an organization to understand the customer messages and thereby improve the communication efficiency and effectiveness. We present a conceptually novel toolset called CRM Sense Maker that has been developed to support CRM managers at a customer support center in a large university. Our tool can summarize customer feedback messages using state-of-the-art text processing techniques such as automatic indexing and clustering.

We claim contributions along several lines. First, we applied a previously studied document clustering approach to CRM domain. Second, we significantly improved the usability of the techniques due to following:

(1) Semi-automatic approach: allowing user interference at the crucial stages to improve the quality of the outcome.
(2) Applying the notion of organizational concept space (OCS) (also referred as the similarity network or thesaurus approach) to address a very well known vocabulary diversity problem, i.e. different words used to refer to same or similar meanings (Furnas *et al.*, 1987).
(3) Integrating a Web mining technique we have developed recently (Roussinov and Zhao, 2003) to obtain OCS automatically from Internet with high reliability. A typical collection of CRM messages, although formidable to analyze manually, does not contain sufficient number of words and phrases to derive a reliable OCS needed for analyzing the messages. That is why we believe

Internet mining is a crucial technique in this context.

The rest of the paper is organized as follows. Section 2 introduces the concepts and techniques of the CRM Sense Maker. Section 3 discusses a business case in which the CRM Sense Maker is applied and tested. Section 4 concludes the paper and points out directions of future studies.

2. CRM Sense Maker

The CRM Sense Maker consists of the following three steps:
(1) identifying descriptive terms;
(2) identifying semantic relationships between them; and
(3) grouping messages into clusters of related issues.

The following subsections explain more in detail what each step does and why it is necessary.

2.1 Identifying descriptors
The content of each text message is described by words and phrases that this message contains, which is currently the most effective and efficient representation known for information scientists and artificial intelligence researchers. Those content bearing words (called terms) are identified through a process called automatic indexing. The general purpose of automatic indexing is to identify the contents of each textual document automatically in terms of associated features, i.e. words or phrases. Automatic indexing first extracts all words and possible phrases in the document. Then it removes words from a "stop-word" list to eliminate non-semantic bearing words such as "the", "a", "on", and "in".

As in the state of the art in text-processing technologies, after automatic indexing, each message (document) is represented by a vector. Each coordinate in the vector space corresponds to a term. If a term is present in the document, the coordinate is set to 1, otherwise to 0. For computational efficiency and accuracy of representation, only the specified number of most frequent terms is used for vector representation. According to Chen *et al.* (1994), Orwig *et al.* (1997), Roussinov and Chen (1999), this approach works best with small collections consisting of short text messages, since it provides the greatest overlap in representations.

The accuracy of this vector representation is crucial for every text technology involved, specifically automatic clustering, categorization, retrieval or summarization. Apart from its statistical properties in the collection of documents

(messages), each term is treated the same way, regardless of its semantic meaning, which apparently results in problems. Some terms do not help to represent messages since they may have too general meaning for the context at hand. Hence, we suggest that manual cleaning of context bearing terms selected for vector space representation is necessary for the technologies to be applicable in real-life (e.g. managerial) applications.

Thus, the first step in the process is an interactive review of the automatically suggested terms. Currently, it is implemented using MS Access database software as shown in Figure 1. The user has three options:

(1) discard a term as non descriptive ("not useful") (e.g. techncial support is too general and not useful in this context since all messages are related to technical support anyway);

(2) identify a term as a definitely descriptive ("Useful"), e.g. telephone; and

(3) do not provide any feedback on a term (default option).

Once, the user is finished, the system gives higher weights to the descriptive terms in the vector space representation of the messages which promotes their influence on the clustering outcome.

2.2 Grouping descriptors into concepts
The vector space model has another serious limitation since it does not take similarities between different words and phrases into account. For example, customer and user would be treated as different words, although in our CRM context they are nearly synonyms.

This problem has also been noticed in a more general domain of text technologies and traditionally known as vocabulary problem (Furnas *et al.*, 1987). However, there has not been an effective solu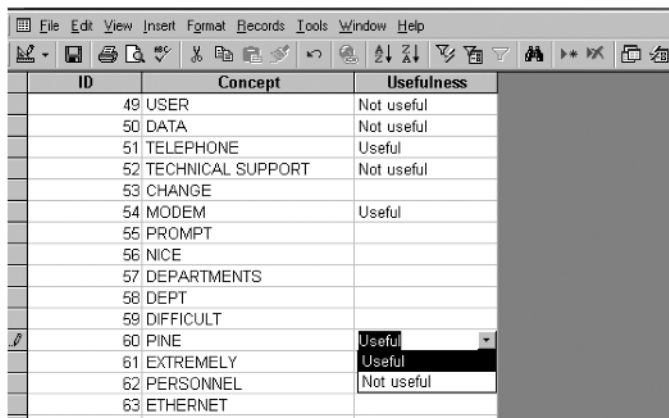tion to it. Since natural languages are very ambiguous and diverse, solving this problem would require knowing semantic relationships between all possible words and phrases. This task is believed to be "AI-complete," (Ide and Véronis, 1998) which means solving it would require solving all the other (AI) Artificial Intelligence tasks such as natural language understanding, common sense reasoning and logical thinking.

Nevertheless, we believe that some progress in the right direction can be made. While solving the problem in the most general setting does not seem to be feasible in the nearest future, alleviating it within a particular organization or a particular task, such as CRM, by applying OCS (Zhao *et al.*, 2000) has been shown to be possible. OCS is an organization specific framework, that among the other data structures, includes a so-called similarity network, a collection of similarity relationships between the important concepts. Figure 2 shows a simple similarity network with generalization (up) – specialization (down) hierarchy. All concepts in the same node of the network or connected by arcs are believed to be strongly semantically related.

Roussinov and Zhao (2003) presented and empirically validated Web mining approach that is capable of discovering semantic relationships between specified concepts, and as a result, helps to organize messages produced during electronic meetings supported by group decision support systems. In their study OCS was successfully "text mined" from the World Wide Web.

In our current project, we combine automated mining with the manual user feedback to build and maintain real size OCSs for the purpose of CRM. Figure 3 shows an example of manual refinement of OCS implemented as editing a specially formatted text file using Notepad editor from MS Windows. Each concept is placed on a new line, and related concepts immediately follow and are indicated by indentation (e.g. Training is related to Classes etc.). The initial relationships are built automatically through the co-occurrence based text mining (Roussinov and Zhao, 2003). Then, a CRM manager can refine them.

Figure 1 Interactive refinement of the descriptive terms

Figure 2 A generic similarity network
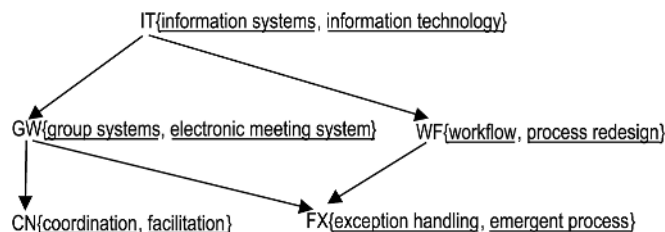
Source: Adopted from Zhao & Kumar & Stohr (2000)

Figure 3 An example of a file showing related concepts grouped together


```
combined200grouped.ter.txt - WordPad
File  Edit  View  Insert  Format  Help

    EXCELLENT
          FRIENDLY
          COURTEOUS
          APPRECIATE
          EXCELLENT JOB
          IMPRESSED
          KNOWLEDGEABLE
          WONDERFUL JOB
          DECENT JOB
    TRAINING
          CLASSES
          CLASS
          COURSES
          TRAINING CLASSES
          TRAINING COURSES
    PERSON
          STUDENT
          STUDENTS
          CUSTOMER
          FACULTY
          USERS
          USER
    NETWORK
          ETHERNET
          NETWORK SUPPORT
          NETWORK SYSTEM
    MODEM
          TELEPHONE
```
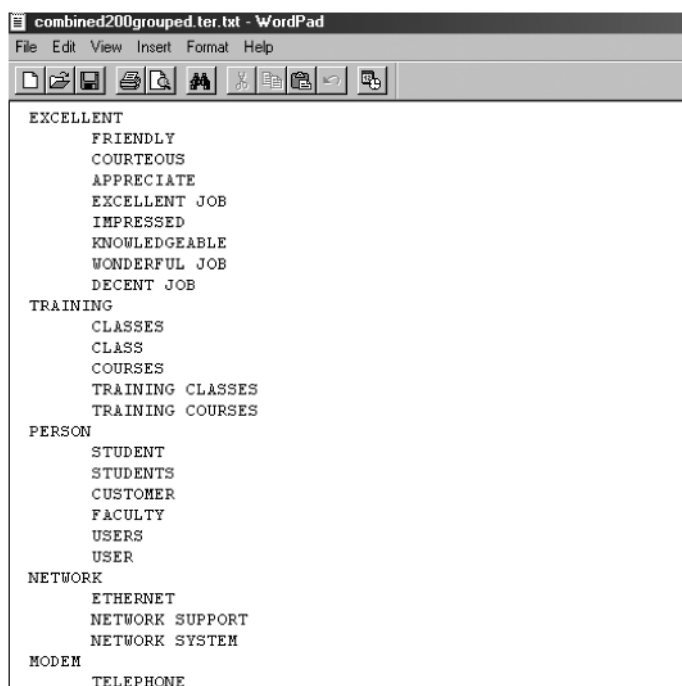
2.3 Clustering messages into issues

Recently, information visualization techniques have revived interest in text clustering. The idea behind many of these techniques that are able to visualize large collections of documents is to agglomerate similar documents into clusters and present a high-level summary (e.g. via a list of the most representative terms) of each cluster. This way, the user does not need to go through similar documents or through entire documents in order to become familiar with the collection. This greatly reduces redundancy and cognitive demand. Examples of such visualization systems are Scatter/Gather (Cutting *et al.*, 1992), WebBook (Card *et al.*, 1996), and SenseMaker (Wang Baldonado and Winograd, 1997). Hearst (1997) gives a comprehensive overview of such systems and the ideas behind them.

Our final step organizes messages (clusters) into groups of similar issues through a semi-automatic interactive procedure. An example of a file containing CRM messages organized into clusters is:

*** New Issue: CLASSES

I attended two lecture/classes for computing during the month of November but I'm not sure if they were CCIT classes: 1) Denise Warren – Web Design 2) Copyright Laws (Web) They were both excellent. I look forward to more of the same.

08 In general, my interactions have been very satisfactory. I am thankful to have an efficient and easy access to the internet. However, I was really

disappointed when you quit offering your free classes for Macintosh users. There are many of us who use Macs on campus and much prefer them to IBM. Please bring back the Mac classes!

More accessibility to services (i.e. help and other informational aspects). Maybe offer classes to help users with different programs. I am not aware of how useful the CCIT is in enchanting my computer use.

08 I gave it an 8 because last year we got to attend a free "Introduction to Computers" class. To give it a 10 I suggest giving free classes to grounds people on programming irrigation boxes. I am speaking about what helps me. I know almost nothing about computer services outside my department.

*** New Issue: EXCELLENT JOB

Excellent work in meeting UA needs during peak volume for SIS. System went down once, I understand, or I would have rated 10. The center is doing a excellent job.

I think you do an excellent job however it would be nice to be up from 7:00-7:00 everyday. Also, more messages to users about downtimes. The help line should have a recording telling us when SIS is expected to be up. We are totally dependent on SIS.

You have been doing an excellent job. However, my office computer is very behind (386) and does not have e-mail or Internet. I took a Faculty Development class but the equipment does not measure up to the knowledge.

FYI – name & name did an excellent job of choosing the appropriate computers for our office & helping us to set up Windows NT.

Excellent job. Send chocolate to earn a score of 10!

Each cluster is described by automatically identified most representative terms (e.g. CLASSES or EXCELLENT JOB) and started with a marker "*** New Issue". The messages are separated by empty lines. First, the initial grouping and assigning labels to clusters is done automatically. Then, the user (a CRM manager) can manually clean up the groups or just glance over them to identify re-occurring issues.

3. Application of the CRM Sense Maker

Currently, we are testing our tool with 1438 CRM messages collected in the period of several years by a computer customer support center in a large university (CCIT). We are in the process of a field study with CCIT CRM managers. Since our prototype system includes several components mentioned above, each of them is being tested and validated empirically. One of our research goals is to develop new techniques for analyzing customer

survey messages and validating the prototype system in the CCIT environment.

CCIT provides comprehensive services to hundreds of units and tens of thousands of users throughout the university community. Its services include e-mail and computer accounts, resources for teaching, campus telephone service, resources for research, resources for administrative systems, and campus networking.

CCIT itself is not an independent organization by itself but rather a sub-organization within a large university, the primary goal of which is to provide college level and graduate education. Due to competitive nature of modern education market, universities strive to achieve the reputation for high quality and degree of customer satisfaction, in which computer services play important role. That is why one of the important missions of CCIT is to perpetually provide and improve the quality of its services. In order to evaluate the quality and elucidate potential drawbacks, CCIT must periodically conduct customer surveys and report the results of analysis of these customer surveys to the upper management as many similar service based units within organizations do.

CRM is also important because CCIT needs to manage customer perception of the importance of CCIT services. For instance, many university employees benefit from improved CCIT services, however, in their feedback, many people say that they do not use CCIT services at all. This finding made the CCIT management realize that they need to do a better internal marketing and committed resources for this cause. A CRM group was put in place permanently to work with the help desk and the strategic planning group.

A customer relationship manager is considered to be a bridge between the customers and the company managers, which must identify important trends in customer sentiment and communicate them convincingly to other corporate managers. The corporate managers then need to take actions to mitigate the problems.

The task of customer feedback analysis requires important several steps.
(1) Gather the customer feedback messages through call center or Web survey.
(2) Read the customer messages (sometimes repeatedly) to discover sensitive and recurrent themes.
(3) Summarize the recurrent themes while reading the messages.
(4) Categorize the customer messages to support the most important themes the manager(s) consider as issues.
(5) Compare with previous customer relationship initiatives to identify improvements in customer sentiments.
(6) Propose corporate actions and estimate resources and impacts of such actions.

Steps (2) - (5) are very time consuming and may take days of work to go over a few hundreds of messages. As our interviews with CRM managers indicated, going over thousands of messages is close to impossible because of time constraints. Consequently, any tools that can help speed up the message analysis process and improve the quality of message categorization will be invaluable to CRM.

Our empirical design includes control and test groups, who are both given the same amount of time to familiarize with the CRM messages. Only some of the test groups have access to our toolset. We are comparing the outcomes to see how well each group is able to analyze the same collection of messages. The metrics used in the field study include the number of valid issues identified, the proportion of correct answers to a set of specially designed questions based among others.

We are currently working with the CCIT CRM managers in order to evaluate the quality of automated pre-processing at each step. A more extensive field study will be our next step once all the algorithms and parameters are tuned based on the data that we currently have.

4. Conclusions

We have analyzed the possibility to alleviate information overload in CRM data contained in a large collection of text messages. We have built a proof of concept prototype and validated the outcome of each step, thus exploring the applicability of the modern text technologies. The existing CRM systems do not contain such tools and therefore are inadequate in assisting CRM managers to analyze their valuable customer information. We believe that the CRM Sense Maker is a first step towards resolving the information overload problem in CRM message analysis.

The CRM Sense Maker can be used in more advanced CRM message analyses such as longitude analysis of CRM messages. By partitioning a collection of CRM messages into moving windows and applying the CRM Sense Maker in the moving windows, one can observe changes in the message patterns in time. This longitude analysis can be applied in two ways. First, significant changes in customer sentiment represent either a worsening or an improvement of

an existing problem. This can be used as a generic management surveillance system. Second, when companies have invested in certain area of business strategically and expect certain business results, the CRM Sense Maker can be used to ascertain if the strategic goal has been achieved or not and to what degree as measured by customer sentiment.

Currently, we are continuing with more field tests and study visual representations such as semantic maps and the use of customer ratings. Semantic maps will help managers to observe the results of analysis in a graphical manager, thereby making the CRM Sense Maker easier to use. The use of customer ratings can potentially make the analysis more accurate since the same phrase used in two CRM messages can have different implications if the two messages have significantly different ratings. For instance, a negative phrase in a CRM message accompanied by high rating of service might be a humorous statement while the same phrase in another CRM message linked to a low rating need to cause an alarm to the CRM manager.

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SiteQual: an integrated measure of Web site quality

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Abstract

The development and testing of an instrument for obtaining user feedback on the overall quality of B2C electronic commerce Web sites, SITEQUAL, is discussed. Using previous research in information quality and service quality as a springboard, a conceptual model and an instrument to measure Web site quality were developed. A factor analysis was conducted which suggested that four minimum Web site quality factors and seven desired Web site quality factors are important to consumers in the retail music industry. The use of Web site quality factors for measurement of consumer expectations and perceptions, determining Web site requirements, and guiding the testing process is suggested.

Introduction

The widespread adoption of computers and networking technologies by individuals and businesses has led to the growth of business-to-consumer (B2C) electronic commerce. However, a rapidly changing business environment has revealed the uncertainty and risk associated with undertaking a B2C project. Understanding the factors used by consumers to determine B2C Web site quality informs system requirements determination, guides the software testing process, and provides a basis for system benchmarking. The purpose of this research is to demonstrate that consumer expectations can serve as a basis for establishing guidelines that systems developers can use in creating and improving B2C Web sites.

The primary focus of e-commerce research in the 1990s was on the development of technologies and architectures that enable the construction of Web sites to link businesses and consumers in the "new economy". The design of high quality Web sites, however, had not been a major focus of either IS organizations (Melymuka, 2001) or many researchers until recently. Major needs exist for the development of instruments to allow for evaluation of customer preferences and their effect on Web site design (Kalakota and Whinston, 1996). Commercially, organizations such as Gomez.com have developed agent-based tools that collect an array of network and Web site data to evaluate quality based on overall Web site performance (Gomez.com, 2003). Researchers investigating Web site quality are using a variety of approaches but have not agreed on a consistent set of constructs and variables affecting B2C Web site success. An analysis of in-depth customer interviews exploring the value of e-commerce produced a number of factors, which were then logically categorized as mean and fundamental objectives (Keeney, 1999). A recent study of B2C Web site factors found significant discrepancies between factors identified in various academic and industrial publications and those rated in a consumer survey (Turban and Gehrke, 2000).

Motivating this research is the need to determine the minimum and desired levels for various service and information quality components in order to establish a baseline which can be used for comparison in future research and practice. Insight in this area can be derived by synthesizing existing research from the fields of marketing and information systems into a coherent model of Web site quality. A conceptual model of service quality (Parasuraman *et al.*, 1985, 1988, 1994) informs research into customer expectations

and perceptions of the buyer processes (Moen and Minor, 1998) Web sites must support. This model provides a validated research instrument (SERVQUAL) for examining service quality. Literature on marketing literature informs research into the processes that must be considered in developing and maintaining a B2C Web site while information (or data) quality informs research on the data component of a Web site. A conceptual model of data quality (Wang and Strong, 1996) provides a basis for examining the various dimensions of information quality. Integration of these models provides a starting point for exploring factors affecting consumer expectations and perceptions of B2C Web site quality while complementing previous research.

Conceptual model of B2C Web site quality

Webb and Webb (2001) developed a conceptual model of the factors affecting consumer perceptions of B2C Web sites. The underlying premise is that two major quality constructs, one focused on information and the other focused on processes, determine B2C Web site quality. This model is consistent with The Reformulated Information Systems Success Model (DeLone and McLean, 2002), a research framework recently revised to add service quality as a major construct of interest. Each of these quality constructs has been conceptualized as consisting of a number of quality dimensions, which are shown on the left side of Figure 1.

Service quality
Service quality has been defined as the degree of discrepancy between customers' normative expectations for service and their perceptions of service performance (Parasuraman *et al.*, 1985). This construct has since been refined and operationalized via the SERVQUAL instrument, which measures the difference in perceptions and

expectations using 21 items measuring: reliability, responsiveness, assurance, empathy, and tangibility (Figure 1). The reliability construct looks at consistency of performance and dependability. Responsiveness relates to timeliness of service. Assurance looks at the competence and courtesy of employees and their ability to inspire confidence and trust. Empathy relates to access and understanding provided by employees. Tangibility relates to the physical evidence of service: facilities, equipment, and personnel (Parasuraman *et al.*, 1988). An extension of the service quality concept is the zone of tolerance. This zone represents the range of service a consumer would consider satisfactory (Parasuraman *et al.*, 1994). The zone of tolerance measures the consumer's expectations of desired service (what consumers believe can and should be provided) and adequate service (the minimum level of service acceptable to the consumer) in an alternative SERVQUAL format. This format is useful for establishing quality goals and measuring progress in attaining those goals as B2C Web sites are evaluated.

SERVQUAL has been validated in a number of industrial settings including some within the field of information systems research although a debate continues on its use including both cautions (Van Dyke *et al.*, 1999) and validation (Jiang *et al.*, 2000). The primary use of SERVQUAL, modified for IS services quality, has related to the delivery of information services by IS departments (Pitt *et al.*, 1995, 1997; Kettinger and Lee, 1995). Recent uses of SERVQUAL in evaluating constructs in the B2C domain have found significant results. Tangibility was associated with increased consumer loyalty and a combined dimension of responsiveness, reliability, and assurance was associated with increased consumer trust (Gefen, 2002). A study of service quality dimensions, which excluded tangibility, found that assurance was associated with consumer agreement (Devaraj *et al.*, 2002). Neither of these studies examined the effects of information quality. Both of these studies limited service quality measures to perceptions only, avoiding the gap score debate. However, more research on user expectations has been called for (Van Dyke *et al.*, 1999) while the usefulness of gap scores in the IS context has been defended (Jiang *et al.*, 2000).

Information quality
Information quality has been measured in various ways over the past three decades and is considered critical in determining information system success (DeLone and McLean, 2002). One of the most comprehensive frameworks for classifying data quality categorizes 20 data quality sub-dimensions

Figure 1 Factors affecting B2C Web site quality
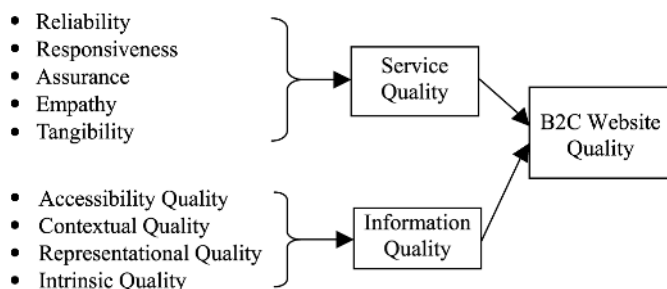
Source: Webb and Webb (2001)

into four major dimensions (Wang and Strong, 1996). Accessibility quality examines access and security of data. Contextual quality considers the timeliness, amount, completeness, and relevancy of data. Representational quality examines the understandability, interpretability, and consistency of data, while intrinsic quality looks at the accuracy, objectivity, and believability of data. While not fully validated, this framework has been used to measure information quality of Web sites (Katerattanakul and Siau, 1999). This initial effort reported some consistency with the data quality framework in the areas of contextual and accessibility information quality, but reportedly needs refinement.

In a study of expectations and disconfirmation, information quality was examined along the dimensions of understandability, reliability, and usefulness (McKinney et al., 2002). Second order factors identified included information quality expectations, performance, and disconfirmation. These findings reinforce the need to examine both user perceptions and expectations of information quality.

Rationale for model integration

DeLone and McLean (2002) call for research into the major constructs that determine information success, which includes the main and joint effects of system, service, and information quality on system use, user satisfaction and ultimately net benefits. In a non-IS environment, an examination of product attributes jointly with service quality suggested that product dimensions had more of an effect on customers' perceptions than did service quality (Genestre and Herbig, 1996). Similarly, an examination of an IS department provided evidence that the quality of the information provided had a greater effect than any service quality dimension assessed using the SERVQUAL instrument (Kettinger and Lee, 1995). Exploration of expectation-perception gaps among the respective dimensions of service quality and information quality within a single study appears to be worthwhile.

Service quality as previously conceived in the marketing literature differs significantly from service quality in a B2C electronic commerce setting. Intimate or person-to-person contact is not a significant aspect of service quality as currently implemented in most electronic commerce environments. The quality of information and its presentation must overcome the lack of personal involvement on the part of a company's salespeople. Information quality is also different in electronic commerce than in other IS settings because the people relying on the information in this setting are external rather than

internal consumers or users. While security concerns such as password protection or employee access to selected database data dominate the traditional IS setting, security in a B2C environment refers to whether customers feel that their financial information will remain secure and private if provided over the Internet to a business.

Recent research has considered a variety of combinations of service, information, and system quality dimensions with mixed results. An examination of service quality dimensions alone on trust and loyalty of B2C Web site users found that tangibility has a significant effect and the five hypothesized dimensions collapsed into three (Gefen, 2002). Other studies have omitted tangibility while studying the effects of service quality dimensions when combined with variables from the technology acceptance model and transaction cost analysis model (Devaraj et al., 2002). Some studies of B2C sites have focused on information quality without considering service quality (McKinney et al., 2002), while others have found evidence that suggest effects of both information and service quality dimensions on dependent variables (Shim et al., 2002).

Given the mixed research findings, there appears to be an overlap in the dimensions of service quality and information quality. In the next section we discuss the data collected to evaluate Web site quality factors when examining both service and information quality constructs.

Data collection and analysis

An instrument was constructed by adapting 21 service quality items (Parasuraman et al., 1994) and 22 items derived from the data quality literature (Wang and Strong, 1996). These 43 items (Table III) were integrated into a survey using the three-column format (Parasuraman et al., 1994) that asked respondents to evaluate each item for minimum, desired, and the perceived quality of a B2C retail site that they had previously used to obtain information or make a purchase. Each item was rated on a nine-point Likert scale (Parasuraman et al., 1994). Although not analyzed in this study, the intent of the perceived quality scale is to provide researchers and practitioners with a means to a metric by which Web site performance can be compared to competitors and over time.

After the pilot study, a survey of B2C Web site users was conducted in the retail sector of music purchases (compact discs and cassettes). Users were selected via a commercial mailing list of music media consumers of Florida. A mail survey was sent to 1,950 users. There were 215 surveys

returned for a response rate of 11 percent, which was consistent with response rates in previous studies using this survey format (Parasuraman *et al.*, 1994). Of these, 178 responses were complete and usable for further analysis.

Data analysis

The demographic profile of survey respondents indicated a mature group of Internet users who were very familiar with B2C retail transactions. Respondents reported shopping online with 22 companies, however five companies (Amazon, CDNow, BMG Music, Columbia House, and Barnes and Noble) constituted 81 percent of Web sites reported as the primary site for purchase of music and CDs. Ninety five percent of respondents made a purchase from the Web site indicated. Use of the Internet was heavy with 96 percent of respondents planning to use the identified Web site again and 92 percent planning on future purchases from that site. Ages of respondents varied, but were generally older than student-based surveys with 10 percent being under 25, 30 percent ranging from 26 to 35, 44 percent were from 36 to 55 and 25 percent were over 55. Females made up 57 percent of the respondents. Education level reported was high school – 25 percent, college – 51 percent, and graduate school – 22 percent. The Internet was accessed from home by 90 percent of respondents. Fifty eight percent of respondents used dial-up modems, while 32 percent reported high-speed access. Respondents were experienced Internet users with only 4 percent reporting use less than one year while 17 percent had been online for 1-2 years, 39 percent for 3-5 years and 40 percent reported over five years of use. The frequency of purchases using the Internet was weekly for 14 percent, monthly for 71 percent, and yearly for 11 percent of respondents. There was considerable experience in electronic shopping with 56 percent of respondents making their first Internet purchase over two years ago while 25 percent began Internet shopping one to two years ago and 17 percent started less than a year ago. Only two respondents had never made a purchase over the Internet.

Survey data was analyzed using principal components factor analysis. A separate analysis was conducted on the consumer's ratings for each of the 43 items. The first analysis evaluated the consumer's minimum acceptable level of service or information while the second evaluated the desired level. Each factor analysis resulted in more than one factor being detected. A varimax rotation was used to better identify and understand the factors involved.

As expected, the factor analysis resulted in fewer than nine factors, shown in Table I. The minimum

level resulted in four factors (Table II) while the desired level resulted in seven factors (Table III). Each factor analysis accounted for over 73 percent of total variation. The desired level factors included reliability, assured empathy, tangibility, navigability, relevant representation, accuracy, and security. With some item exceptions, three factors: reliability, tangibility, and accuracy correspond to factors identified in the service and data quality literature. Two factors were formed from combined items contained in the factors identified separately in the service and data quality literature. Items derived from the factors assurance and empathy in the service quality literature loaded on the same factor, which was renamed assured empathy. Items derived from contextual and representational data quality in the data quality literature also loaded on a unique factor, which was renamed relevant representation. Accessibility data quality items loaded on two separate factors, which were named security and navigability.

For the minimum level of quality, the principal component analysis of the 43 items resulted in four factors. These four factors were reliability, assured empathy, perceived usability, and trustworthiness. The first two were consistent with the factors that emerged from the analysis of desired items. The third factor, perceived usability, was derived from a combination of items that loaded on three desired factors (tangibility, navigability, and relevant representation). The last factor primarily consisted of security plus items that loaded on accuracy in the analysis of desired items.

Discussion

The analyzed data suggest that a combination of quality factors derived from service quality and data quality are needed to evaluate both desired and minimum quality factors expected of a B2C Web site. Of the seven desired quality factors, six are aligned with factors derived from the service and information quality literature (Table I). The five original service quality factors were collapsed into three of the seven desired quality factors of a B2C Web site (reliability, assured empathy, and tangibility). Three of the desired quality factors (navigability, relevant representation, and accuracy) are aligned with data quality factors. One new quality factor, security, emerged from this analysis. Although items measuring security were conceptually conceived as measuring accessibility, strong loadings of items at 0.799 and 0.816 distinguish them as a separate desired factor. The data suggest that in the B2C environment, security is an important dimension, more so than in the

Table I Comparison of derived, desired, and minimum B2C quality factors

A priori factors derived from service and data quality literature	Desired B2C Web site quality factors	Minimum B2C Web site quality factors
Service quality factors (Parasuraman *et al.*, 1994)		
Reliability	Reliability	Reliability
Responsiveness		
Assurance		Assured empathy
Empathy	Assured empathy	
Tangibility	Tangibility	
Data quality factors (Wang and Strong, 1996)		Perceived usability
Accessibility (a)*	Navigability	
Contextual		
Representation	Relevant representation	
Intrinsic	Accuracy	
Accessibility (b)*	Security	Trustworthiness

Notes: *Data accessibility, a single factor in the derived data quality model, split into two factors during analysis of both desired and minimum quality factors (a) navigation related and (b) security related

traditional retailing environment. The original conceptualization of SERVQUAL included security as a unique dimension (Parasuraman *et al.*, 1985). It appears that in a B2C environment, security is important enough to warrant separate consideration.

Some of these results were unexpected. While the service quality and data quality factors did collapse into fewer than nine factors; they did not collapse entirely in the manner anticipated. Yet, the factors seem reasonable in that security and accuracy together can be viewed as a measure of trustworthiness, which should be relevant to consumer perceptions of Web site quality. The emergence of security, which includes privacy of information and security of transactions as a desired factor highlights the concerns of B2C consumers. This is not unexpected given major consumer alerts on viruses, hackers, identity theft, and protection of information by businesses. Responsiveness, a factor that is the subject of many studies and the domain of automated tools, did not emerge as a single factor. Other consumer surveys have found low ratings for responsiveness (Turban and Gehrke, 2000). One explanation may be the focus on business-level responsiveness rather than system-level responsiveness in the wording of the SERVQUAL derived items. Another explanation could be the increasing number of respondents with broadband Internet access and its inherently faster page-loading rates, which reduces consumer concern.

The classification of features as essential versus desired is critical to setting system scope and prioritizing effort during system development and maintenance (Hoffer *et al.*, 2002). As for the essential (minimum) quality factors of B2C Web sites, four factors emerged including reliability, assured empathy, perceived usability, and trustworthiness. The factors that emerge in

the data analysis suggest that consumers consider a reduced set of quality factors to be essential as opposed to desired. This distinction is derived from the value that consumers attach to each factor (Keeney, 1999). Reliability, a service quality factor, consistently emerges as a factor in both analyses. Assured empathy, while a combination of two service quality factors, consistently emerges as both a minimum and a desired quality factor. The third factor, perceived usability, consists of items derived from both service and data quality. The fourth quality factor consists of security, the newly emerged desired factor, which is combined with accuracy to form trustworthiness. Consumers of B2C Web sites appear to have a set of minimum quality factors that are considered necessary, at least in the retail music environment. These Web sites must be reliable, considerate of user needs, easy to navigate, and trustworthy.

While these represent the minimum acceptable levels of B2C Web site quality, consumers desire more from Web sites. These additional qualities include accuracy, relevant representation, Web site navigability, and a distinction between information accuracy and security. The desired quality factors are also derived from a combination of service quality items and data quality items suggesting the need to integrate these factors when designing Web sites and assessing overall Web site quality.

Theoretical implications and future research

This study concentrated on user expectations in just one segment of B2C retailing. Future studies are needed to see if minimum and desired factors are similar across product lines, various services (investments and banking), and with high cost

Table II Item definition and minimum B2C quality factor loadings (principal components factor analysis with varimax rotation)

Variable	Reliability $\alpha = 0.92$; $n = 4$	Assured empathy $\alpha = 0.83$; $n = 5$	Perceived usability $\alpha = 0.97$; $n = 18$	Trustworthiness $\alpha = 0.90$; $n = 5$
		Cronbach α and n		
Service quality items . . .we would like your impressions the Web site's service performance of the company you indicated. . . When it comes to *(insert phrase below)*, My *Minimum (Desired in* Table III*) Service Level Is:*				
Reliability1. Providing goods/services as promised	0.7996	0.1691	0.1497	0.1637
Reliability2. Dependability in handling customers' service problems	0.7956	0.2157	0.1622	0.1860
Reliability3. Performing services right the first time	0.7261	0.2008	0.3063	0.3350
Reliability4. Providing services at the promised time	0.6862	0.2778	0.3892	0.2175
Responsiveness1. Keeping customers informed about when services will be performed or products delivered	0.4255	0.5416	0.4731	0.1161
Responsiveness2. Prompt service to customers	0.5006	0.4702	0.4350	0.2984
Responsiveness3. Making it easy to communicate with the organization	0.5045	0.5566	0.2941	0.2771
Responsiveness4. Readiness to respond to customers' requests	0.5371	0.5360	0.3398	0.2664
Assurance1. Web sites that instill trust in customers	0.3416	0.4338	0.4057	0.3352
Assurance2. Making customers feel safe in their transactions	0.2994	0.5024	0.2158	0.5304
Assurance3. Minimizing Web site-oriented distractions and interruptions	0.1869	0.6844	0.3055	0.3043
Assurance4. Containing information to answer customer questions	0.2445	0.7228	0.4171	0.1736
Empathy1. Giving customers individual attention	0.1902	0.7184	0.4772	0.1930
Empathy2. Dealing with customers in a caring fashion	0.2703	0.6611	0.4056	0.2520
Empathy3. Having the customer's best interest at heart	0.2226	0.6226	0.4149	0.3690
Empathy4. Understanding the needs of their customers	0.2287	0.4906	0.5558	0.3271
Tangibility1. Availability of the Web site	0.2822	0.2468	0.5804	0.3785
Tangibility2. Supporting the latest technology	0.1896	0.2473	0.7136	0.1465
Tangibility3. Presenting an overall visually appealing Web site	0.0746	0.3725	0.7487	0.0826
Tangibility4. Presenting a neat, professional appearance	0.2377	0.2973	0.7187	0.1843
Tangibility5. Visually appealing materials within the Web site	0.0892	0.3511	0.7554	0.1891
Data quality items . . .we would like your impressions regarding the quality of information provided by your most used Web site as indicated . . ., please indicate: your *minimum (Desired in* Table III*) information quality level* . . .				
Intrinsic1. Providing accurate information	0.4133	0.1656	0.3758	0.6226
Intrinsic2. Providing believable information	0.2891	0.1469	0.4373	0.6581
Intrinsic3. Providing unbiased information	0.3279	0.2604	0.4126	0.5538
Intrinsic4. Having a good reputation	0.2626	0.3049	0.4999	0.5598
Contextual1. Containing relevant information	0.3240	0.2671	0.6416	0.4043
Contextual2. Providing information in a timely manner	0.2673	0.3382	0.6793	0.3970
Contextual3. Offering complete information	0.3246	0.2363	0.6251	0.4706
Contextual4. Offering the right amount of information	0.1999	0.3561	0.7679	0.2646
Contextual5. Offering information at the appropriate level of detail	0.2158	0.3783	0.6993	0.2890
Contextual6. Providing a value-added experience	0.2187	0.3541	0.7002	0.1768
Representation1. Presenting data that is easy to interpret	0.3763	0.3104	0.5595	0.4778
Representation2. Presenting data that is easy to understand	0.3836	0.2540	0.5881	0.4759

(continued)

Table II

Variable	Reliability	Assured empathy	Perceived usability	Trustworthiness
		Cronbach α and n		
	$\alpha = 0.92$; $n = 4$	$\alpha = 0.83$; $n = 5$	$\alpha = 0.97$; $n = 18$	$\alpha = 0.90$; $n = 5$
Representation3. Having a well-organized site	0.3566	0.1245	0.6909	0.3993
Representation4. Using representations that are consistent and make sense	0.3796	0.2167	0.6136	0.4292
Representation5. Providing information in an appropriate format	0.3048	0.3358	0.6777	0.2959
Representation6. Providing information in a concise format	0.2175	0.3518	0.7236	0.3043
Accessiblity1. Making information easily available to me	0.3510	0.2417	0.6584	0.3698
Accessiblity2. Having a Web site that is easy to find	0.2193	0.2158	0.7150	0.3616
Accessibility3. Having things where you expect to find them	0.2659	0.2535	0.7584	0.1892
Accessibility4. Providing tools to make it easy to find your way around the Web site	0.1884	0.2637	0.7154	0.2877
Accessiblity5. Providing adequate levels of security for personal information	0.1409	0.2431	0.2095	0.8407
Accessiblity6. Demonstrating a commitment to privacy of my information	0.1470	0.1867	0.2164	0.8340
Explained variance	*5.8091*	*6.4287*	*12.9581*	*6.5078*
Proportion of total variance	*0.1351*	*0.1495*	*0.3014*	*0.1513*

products and services (automobiles, real estate, travel, etc.) as well as with less mature demographic segments. The development and assessment of an instrument for measuring factors affecting quality can enhance future research in the area of electronic commerce and provide industry practitioners with a diagnostic tool and feedback mechanism to aid in the identification of gaps between consumer Web site expectations and perceptions. More research needs to be conducted to examine the dimensions included in both information quality and service quality to determine their relevance and relative importance in measuring B2C Web site quality. Findings of recent research highlight the various approaches to combining factors potentially affecting B2C Web site satisfaction and success. Given the variety of approaches to conceptualizing quality factors, future research needs to carefully evaluate the operationalization of constructs. The selection of measurement items, from the wide range of closely related high level constructs examined to date, must consider content, construct, convergent, and discriminate validities and their effect on further analysis.

Implications for practice

Findings from this research provide a set of essential and desired quality factors that developers can use when developing requirements for B2C Web site systems (Table IV). These quality factors should be integrated into the requirements for B2C Web sites and be used as the basis for the development of test planning and metrics for the evaluation of B2C Web site software during development (Webb and Yadav, 2003). For example, the significance of items relating to reliability indicate that developers need to provide a way to handle service problems and keep customers informed as to when services will take place. IEEE Standard 1061-1998 (1998) provides a methodology for addressing software quality, the degree to which a desired combination of attributes is possessed. The purpose of the software quality metrics framework is to facilitate the early establishment of quality requirements, communicate factors in terms of quality sub-factors, and identify related metrics in software development. There is not, however, a unified set of factors to aid developers and users in implementation of the quality metrics methodology. Developers are left to search through an array of literature for potential factors and sub-factors that must ultimately be measured to assess the quality of a system.

This research fills that void for B2C Web site developers. Metrics derived from studies such as these and the use of gap scores obtained by comparing perceptions of Web site factors to minimum and desired levels, allow the B2C Web site developer to identify quality areas that may present problems and focus efforts to improve

Table III Desired B2C quality factor loadings (principal components factor analysis with varimax rotation)

Items (see Table II for item definitions)	Reliability α = 0.84; n = 4	Assured empathy α = 0.92; n = 8	Tangibility α = 0.86; n = 4	Navigability α = 0.80; n = 3	Relevant representation α = 0.92; n = 6	Accuracy α = 0.93; n = 8	Security α = 0.86; n = 2
Service quality items							
Reliability1	0.6011	0.1623	0.1039	0.0398	0.3101	0.1303	0.4004
Reliability2	0.5861	0.1826	0.0766	0.4861	0.2246	0.1587	0.0165
Reliability3	0.7451	0.2957	0.1325	0.1520	0.2184	0.1191	0.1033
Reliability4	0.6095	0.1499	0.0780	0.1737	0.3290	0.2782	0.1044
Responsiveness1	0.4314	0.2171	0.2256	0.2296	0.3778	0.1669	0.1255
Responsiveness2	0.4399	0.3641	0.1869	0.1825	0.0764	0.3143	0.3382
Responsiveness3	0.4311	0.4473	0.0280	0.0426	−0.0073	0.3406	0.3032
Responsiveness4	0.5836	0.4220	0.0870	0.1605	−0.0055	0.2910	0.2717
Assurance1	0.3433	0.4940	0.1970	0.1943	0.4294	0.2229	−0.0696
Assurance2	0.4488	0.6495	0.0842	0.0478	0.0637	0.2005	0.1066
Assurance3	0.3597	0.6577	0.1089	−0.0145	0.2103	−0.0301	0.3238
Assurance4	0.2227	0.7573	0.1969	0.0278	0.1567	0.1593	0.3367
Empathy1	0.0764	0.7269	0.2464	0.1065	0.3979	0.0584	0.1702
Empathy2	0.1448	0.7210	0.1198	0.2379	0.2417	0.3521	0.0163
Empathy3	0.1331	0.6727	0.2057	0.0285	0.3432	0.4352	0.1515
Empathy4	0.0043	0.5865	0.3408	0.3825	0.2481	0.2981	0.0452
Tangibility1	0.1129	0.4013	0.3465	0.3677	0.1434	0.5904	0.0312
Tangibility2	0.0137	0.2326	0.6151	0.3029	0.2314	0.2542	0.0994
Tangibility3	0.0156	0.2257	0.8031	0.2801	0.1384	0.0616	0.0572
Tangibility4	0.2775	0.1745	0.6623	−0.0918	0.2455	0.3514	0.0166
Tangibility5	0.1333	0.1750	0.7592	−0.0014	0.2205	0.1348	0.1367
Data quality items							
Intrinsic1	0.2310	0.4083	0.0426	0.1048	0.1692	0.7170	0.1183
Intrinsic2	0.1102	0.1511	0.1519	0.1516	0.3391	0.5929	0.3910
Intrinsic3	0.1422	0.2549	0.2206	0.0917	0.3565	0.4773	0.4235
Intrinsic4	0.2776	0.2160	0.2967	0.3116	0.2471	0.4951	0.2305
Contextual1	0.0696	0.2309	0.3016	0.1579	0.3651	0.5308	0.3507
Contextual2	0.2015	0.3377	0.2198	0.1978	0.4326	0.3104	0.4727
Contextual3	0.1694	0.3108	0.1668	0.1489	0.3388	0.6468	0.2902

Cronbach α and n

(continued)

Table III

Items (see Table II for item definitions)	Reliability	Assured empathy	Tangibility	Navigability	Relevant representation	Accuracy	Security
				Cronbach α and n			
	α = 0.84; n = 4	α = 0.92; n = 8	α = 0.86; n = 4	α = 0.80; n = 3	α = 0.92; n = 6	α = 0.93; n = 8	α = 0.86; n = 2
Contextual4	0.1135	0.3005	0.2575	0.2862	0.6568	0.2570	0.2106
Contextual5	0.1343	0.2931	0.1374	0.2089	0.7023	0.2489	0.2278
Contextual6	0.1464	0.1624	0.2266	0.1722	0.7620	0.1282	0.0477
Representation1	0.2185	0.4230	0.0834	0.0858	0.5250	0.3233	0.4282
Representation2	0.2175	0.3618	0.0819	0.1004	0.5460	0.3477	0.4848
Representation3	0.2791	0.0346	0.3521	0.3098	0.2969	0.6052	0.1432
Representation4	0.2089	0.1867	0.2276	0.1006	0.6167	0.4003	0.3181
Representation5	0.2012	0.1881	0.1423	0.3756	0.6683	0.2480	0.0511
Representation6	0.1129	0.2314	0.2283	0.4668	0.6611	0.0916	0.2287
Accessibility1	0.2443	0.2074	0.0345	0.4352	0.3416	0.4878	0.2755
Accessibility2	0.1362	0.0271	0.3496	0.6502	0.2390	0.0150	0.4315
Accessibility3	0.1113	− 0.0061	0.1224	0.6046	0.3636	0.4097	0.1751
Accessibility4	0.1970	0.1703	0.0509	0.7496	0.3319	0.2412	0.1479
Accessibility5	0.1390	0.0807	0.0875	0.1969	0.1685	0.1906	0.8169
Accessibility6	0.0831	0.2647	0.0066	0.1318	0.1332	0.1336	0.7996
Explained variance	*3.9030*	*5.9232*	*3.4989*	*3.4337*	*5.9671*	*5.1612*	*3.9447*
Proportion of total variance	*0.0908*	*0.1377*	*0.0814*	*0.0799*	*0.1388*	*0.1200*	*0.0917*

Notes: Significant factor loadings are in italic type using a factor loading level of 0.45 loading (except cross-loading factors), an implementation of guidelines for identifying significant factor loadings based on sample size at an α significance level of 0.05 and power level of at least 80 percent (Hair *et al.*, 1995)

Table IV Guidelines for B2C Web site development

Quality factor/sub-factor	Priority	Critical system requirements
Reliability	Essential	Provide goods and service as promised, when promised
		Handle service requests dependably
		Perform services without error
Assured empathy	Essential	Minimize distractions
		Anticipate and answer customer questions on Web site
		Personalize Web site
		Keep customer best interests in forefront
		Deal with customers in a courteous manner
Perceived usability	Essential	
Tangibility	Desired	Provide latest technology
		Design for overall visual appeal
		Provide a neat and professional appearance
		Design each Web site component for visual appeal
Navigability	Desired	Design site for easy internal navigation (clear menu, links, depth of paths)
		Register site for easy location (search engines)
		Provide for internal search capability
Relevant representation	Desired	Display the right amount of information for the task without overload
		Provide an appropriate level of detail to the task
		Provide a value-added experience
		Use consistent standardized representations/metaphors
		Use appropriate format for information displays
Trustworthiness	Essential	
Accuracy	Desired	Provide accurate information
		Provide believable information
		Eliminate bias in information provided
		Build reputation of Web site
		Provide relevant information
		Provide complete information
Security	Desired	Demonstrate commitment to privacy of personal information
		Provide adequate level of user security

the quality of existing Web sites. The collection of gap scores over time allows the developer to assess the effectiveness of modifications to Web sites as well as identify changes in user expectations as the B2C retailing environment matures. When combined with automated performance evaluation tools, this approach has the potential to better inform management and developers about the overall quality of their systems.

systems specifications, focus testing efforts, and evaluate potential modifications to existing B2C Web site designs and operations. The model presented focuses future research on extending the knowledge of quality dimensions affecting B2C Web sites in order to more fully develop guidelines for B2C Web site development and provides both researchers and practitioners with a tool to aid both academic research and the construction of B2C systems.

Conclusion

While electronic commerce is still in its infancy there have been significant failures. The development of high quality B2C information products and services is an important issue addressed through the development of a model for understanding consumer perceptions and expectations that lays the foundation for the development of a validated measurement instrument. Identification of B2C quality factors may be used to better understand user requirements, aid in the development of B2C

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The impact of e-marketplaces on dyadic buyer-supplier relationships: evidence from the healthcare sector

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Abstract

This study seeks to explore the impact of e-marketplaces on dyadic buyer-supplier relationships in the healthcare sector. In particular it seeks to determine if the "move to the middle" hypothesis put forward by Clemons *et al.* will be supported in this domain. Case studies of four buying organisations in the healthcare sector (hospitals) and two suppliers (medical device companies), representing eight dyadic buyer supplier relationships were undertaken. It was found that the adoption of e-marketplaces is associated with a reduction in the number of suppliers used by the buying organisations; a deepening of the relationship with the remaining suppliers and an increased "blurring of the boundaries" between the two parties.

Introduction

Interest in the potential benefits offered by e-marketplaces has been considerable. Buying organisations, it has been envisioned, will use such marketplaces to access a wide range of suppliers to compare their products and prices and switch between suppliers (Essig and Arnold, 2001). Suppliers would find marketplaces attractive because they could easily and cost effectively reach new customers. Such observations have led to the suggestion that, in the near future, the majority of business procurement will be undertaken via such services (Nairn, 2000), although current adoption is more modest, with approximately one quarter of companies in the UK using marketplaces for the purchase of goods or services (Institute for Supply Management, 2002).

A number of e-marketplaces are thriving. Covisint, a marketplace in the automotive sector, has conducted more than $33 billion in transactions since its launch in August 2000 (Karpinski, 2001) and Altra, a marketplace in the energy sector has carried out more than $1 billion worth of transactions and claims to be profitable (Harbin and Fontanella, 2001). However, other marketplaces, including high profile players such as Chemdex, MetalSpectrum, GoFish, and E-Chemicals, have closed (Miller, 2001; Karpinski, 2001). A recent study of e-marketplace failures by Laseter and Capers (2002) found that marketplaces owned by a consortium of either buying or supplying companies and that offered purchasing via a digital catalogue or wide range of services were most likely to succeed.

A key reason for failure is the reluctance of sellers to participate in marketplaces where they perceive the over-riding criterion for comparison with competitors is that of price (Wise and Morrison, 2000). Sellers believe that such marketplaces will undermine the relationships that they have established with their customers, which are often based on human contact and communication (Jap, 2000). This study, which is exploratory in nature, seeks to investigate the impact of e-marketplaces on the relationship between buyers and suppliers. It focuses on dyadic buyer-supplier relationships in the specific case of the healthcare sector. In particular the study seeks to determine if the "move to the middle" hypothesis put forward by Clemons *et al.* (1993) will be supported in this domain. These authors suggest increased adoption of inter-firm IT systems will lead to a reduction in the number of suppliers used, improved buyer-supplier relationships and an increased blurring of organisational boundaries. This supplier rationalisation and deepening of relationships is

counter-intuitive to the open market structure enabled by the many-to-many connections that typify e-marketplaces.

This study is of importance to all firms participating in electronic markets. Without an understanding of how electronic trading can improve relationships with customers, suppliers will continue to be reluctant to participate in e-marketplaces. Without their participation, such marketplaces will be unviable and the many benefits forecast from them for all parties in the supply chain will not be realised. The use of IT to support supplier relationship management (SRM) is rapidly gaining in currency (Price Water House Coopers, 2002) and is expected to become as significant as customer relationship management (CRM). This study demonstrates how e-marketplaces can form a valuable part of such an IT-enabled SRM strategy.

This paper commences with a review of current literature in the e-marketplace domain and of literature addressing the impact of electronic transactions on buyer-supplier relationships, including the move to the middle hypothesis. The method adopted for the study is then discussed and the operation of the focal e-marketplace for this study, through which the eight buyer-supplier dyads were trading is described. The findings of the study are presented in terms of the three key constructs of the "move to the middle" hypothesis. A summary and discussion of the study is then given including directions for future research.

E-marketplaces: review of current literature

Commerce between organisations has been facilitated by electronic means for almost 40 years (Sawabini, 2001). Until the late 1990s this has been achieved primarily via Electronic Data Interchange (EDI), which is described by Chen and Williams (1998) as the "electronic transmission of information or documents between computer systems in different organisations based on a standard, structured, and machine retrievable format". Despite considerable benefits being derived from EDI by many organisations (Iacovou et al., 1995; Angeles et al., 2001; Truman, 2000), it also presents a number of limitations. In particular, the requirement to use proprietary value added networks (VANs) and the existence of competing data format standards. This first limitation has been addressed by the recent development of Internet EDI, in which EDI data is transmitted across non-proprietary Internet protocol (IP) networks, such as the Internet

(Chaffey, 2002). Such developments have reduced the cost and complexity of EDI adoption and hence increased the ability of smaller organisations to participate in this way of trading (Sawabini, 2001; Threlkel and Kavan, 1999). However, this development fails to adequately address the other significant issue of competing data standards, resulting in an interest in the development of more open means of effecting business to business electronic trading offered by e-marketplaces.

The development of Internet based e-marketplaces began in the late 1990s and the number grew rapidly between 1999 and 2000 (Schram and Sexton, 2000). By 2001 a study by Laseter et al. (2001) identified 2,233 marketplaces. However, many of these marketplaces have not yet, and perhaps never will be processing transactions. It has been estimated that currently there may be as few as 100 marketplaces undertaking transactions (Miller, 2001).

Owing to the relative immaturity of e-marketplaces and the significant amount of change that has occurred in their short lifetimes, there is not as yet a widely accepted definition of what constitutes an e-marketplace. Strader and Shaw (1997) define them as "an inter-organisational information system that allows the participating buyers and sellers to exchange information about prices and product offerings" and Choudhury et al. (1998) as "an inter-organisational system through which multiple buyers and sellers interact to accomplish one or more of the following market-making activities; identifying potential trading partners, selecting a specific partner, and executing the transaction". Many marketplaces offer services in addition to the buying and selling of goods and any definition should reflect these wider services. We therefore propose the following definition, which we adopt as a basis for this study: "*e-marketplaces are web-based systems which enable automated transactions, trading or collaboration between business partners*".

The immaturity of e-marketplaces also results in there being a paucity of published academic papers in this domain. Both Jap (2000) and Smart and Harrison (2001) investigate the specific use of e-marketplaces to undertake procurement auctions. These studies conclude these auctions can offer benefits to both buyers and suppliers, but caution that firms using them should consider the potential impact on buyer-supplier relationships. Kaplan and Sawhney (2000) offer a useful classification of e-marketplaces based on what is being bought, that is whether it is an input to the products or services manufactured or not, and how it is bought. Here they differentiate between systematic sourcing, where relationships are established between buyers and sellers, and spot

sourcing, where the buyer's only goal is to find the required products at the lowest cost. Essig and Arnold (2001) consider e-marketplaces from an information economics perspective and generate business models which "demonstrate the value added by (such) e-procurement".

In contrast to the lack of academic studies, numerous articles have appeared in the business and trade press on e-marketplaces (Chan, 2001; Karpinski, 2001; Nairn, 2000) and a number of reports have been published on the topic of e-marketplaces by consultancies and software vendors (Bonno, 2001; Brooks and Cantrell, 2001; Laseter et al., 2001; Laseter and Capers, 2002).

Marketplaces can be categorised based on industry orientation: vertical, horizontal and diagonal (Angeles et al., 2001). Vertical marketplaces provide products and services that are specific to a particular industry. Horizontal marketplaces provide products and services that are used by many different industries, sometimes termed maintenance, repair and operations (MRO). Diagonal marketplaces specialise in providing a tailored service to support a specific type of buyer or seller, or specific type of product category across multiple industries (Sculley and Woods, 1999). A number of articles and reports have sought to classify e-marketplaces based upon the number of owners and their role in the marketplace (Krammer et al., 2001; Karpinski, 2001; Lawrence, 2001). Three classes of marketplaces have been identified. Third party or public marketplaces are owned and operated by one or more independent third parties. Consortium marketplaces are formed by a collaboration of firms that also participate in the marketplace either as buyers or suppliers. Private marketplaces are formed when a single company develops an electronic network to undertake trading with either their customers or suppliers or both of these parties.

The first e-marketplaces tended to be based solely on aiding procurement for both buyers and suppliers. Laseter et al. (2001) have found that only the minority of marketplaces currently offers services that go beyond aiding firms with procurement. The additional services these authors identify now being offered include; information exchange, digital catalogues, logistics services, supply chain planning and design collaboration.

Impact of electronic trading on buyer-supplier relationships

Transaction cost economics (Williamson, 1975; Klein et al., 1978) describe the economic activity between firms in terms of two competing costs; production costs and transaction costs. Production costs are the actual prices paid for goods or services. Transaction costs are those additional costs incurred in undertaking the transaction such as identifying potential suppliers, comparing prices and terms and negotiating contracts. It is argued (Williamson, 1975; Klein et al., 1978) that firms that purchase goods from external suppliers, rather than produce them themselves will benefit from lower production costs. External suppliers may well be able to benefit from economies of scale and competition between suppliers will ensure that prices are moderated. In contrast, it is argued that transaction costs are minimised if a firm produces goods internally. Firms must therefore determine an appropriate trade-off between each of these two types of cost for each of the inputs to their own products and services.

The two types of cost result in a dichotomy of basic mechanisms for coordinating transactions; markets and hierarchies (Malone et al., 1987). In markets, buyers search many suppliers to find the goods that they want and will switch to alternative suppliers if they offer lower prices. In such transactions, production costs are minimised but transaction costs are high. In hierarchies, firms form enduring relationships with a small number of suppliers. In such cases transaction costs are reduced, but production costs may well be higher than could be achieved from other suppliers.

Early consideration of the impact of electronic inter-firm transactions on market structure was undertaken by Ciborra (1983), who recognised that such linkages could reduce transaction costs. Malone et al. (1987) formalised this observation when they proposed the electronic market hypothesis (EMH), also termed the "move to the market" hypothesis, as follows;

> By reducing the costs of coordination, IT will lead to an overall shift toward proportionately more use of markets – rather than hierarchies – to coordinate economic activity

Subsequent studies have been undertaken to empirically validate the EMH (Hess and Kemerer, 1994; Daniel and Klimis, 1999) and find limitations to this theory.

In their consideration of the impact of electronic transactions on market structure Clemons and Row (1992) concur with Malone et al., in suggesting that IT will cause a move away from ownership, or vertical integration. In a later study, Clemons et al. (1993) extend this argument and propose an important variation on the hypothesis of Malone et al. Rather than search for these external goods from many suppliers, as occurs in a market structure,

The firm will rely on fewer suppliers than before, with whom the firm will have close and long-term relationships and with whom the firm will cooperate and coordinate closely.

Linked to this observation, they assert that due to the closer relationships with suppliers, firms will allow activities that they currently undertake in-house to be carried out by their suppliers, an effect that they state will cause the blurring or change to the boundaries of the firm. These two observations form the "move to the middle" hypothesis.

The authors suggest that there are a number of reasons why the increased use of IT will result in fewer, but longer term relationships with suppliers which in turn will lead to more activities being undertaken outside the organisation's traditional boundaries. First, they consider that there are certain sunk costs in establishing inter-organisational systems. Although the costs of IT are reducing significantly and there is an increased adoption of open standards, both of which would suggest a reduction in sunk costs, there are still significant costs associated with the establishment of human relationships and with the redesigning of business processes. This suggests that there are transactional economies of scale which argue for fewer suppliers. These same investments in specific relationships and process changes also argue for establishing longer-term relationships with the chosen suppliers, since this then provides greater time in which to recoup these investments. In a study of the adoption of just-in-time (JIT) systems, O'Neal (1989) found that 65 per cent of respondents found their relationships with business partners were longer subsequent to adopting such systems. In his study of the textile industry Holland (1995) found that inter-organisational information systems constitute an important component of enduring co-operative relationships between trading partners, a finding which is in agreement with those of Bytheway and Dhillon (1996). It has also been observed that firms may choose to contract with fewer suppliers, since this gives suppliers greater incentives to invest in innovation or improvements in quality (Bakos and Brynjolfsson, 1993) or to produce customised products (Clemons et al., 1993).

Study methodology

The purpose of this study is to explore the impact of e-marketplaces on the relationship between buyers and suppliers. Since research in the domain of e-marketplaces is still in its early stages due to their relative youth, this study is exploratory rather than confirmatory in nature. An approach based on a small number of in depth case studies with relevant organisations was therefore adopted (Yin, 1989; Eisenhardt, 1989).

An earlier preliminary study by the authors (White et al., 2002) considered the effect of e-marketplaces on relationships based on the views of buying organisations alone. Extending this work to incorporate the views of both parties to such dyadic relationships may be expected to increase the reliability of such a study and also to provide greater insights. In order to identify a number of trading dyads, e-marketplaces with a number of established buyers and suppliers were identified. Mindful of the findings of Laseter and Capers (2002) on e-marketplace failures, it was preferred that the chosen marketplace(s) should be consortium owned and offering either catalogue buying services or a wide range of services. The e-marketplace the Global Healthcare Exchange (GHX) was identified as fulfilling the research criteria. In addition to being an important sector for all economies, Harland (1996) associates the healthcare sector with supply networks, suggesting the importance of enduring relationships in this sector.

Case studies of four buying organisations (hospitals) and two supplying organisations (medical device manufacturers) were undertaken as shown in Table I. Each of the hospitals traded with both of the suppliers, resulting in eight dyadic buyer-supplier relationships. The two supplying organisations interviewed are both equity owners of GHX. Interviews were undertaken with a total of eight managers from the six case study organisations. An interview was also undertaken with a manager from the e-marketplace, GHX. All interviews were semi-structured and lasted between one and three hours. All interviews were tape recorded and transcribed. All interviews were carried out in the period between April and November 2002.

The next section describes in more detail the operation of the electronic marketplace that the eight trading dyads studied were using and hence which forms a focal part of this study, the GHX.

The global healthcare exchange

The GHX (www.ghx.com) is a US based electronic marketplace that was established in March 2000 by a consortium of 16 leading suppliers of healthcare products, such as Johnson and Johnson and GE Medical Systems. These suppliers are either principle equity members (6) or minor equity members (10) and have

Table I Summary of case study findings: buying and supplying organisations

Case study buyer/supplier	Geographic location	Use of GHX e-marketplace	Reduction in supplier numbers	Evidence of improved relationship	Evidence of increased blurring of organisational boundaries
Leeds Teaching Hospitals NHS Trust	UK	Since 4th January 2002 with Boston Scientific	6,000 suppliers three years back. Currently 3,000 Wish to reduce this to 2,000 in near future	Improved communication No errors Visits from senior supplier staff Cooperative SCM initiatives	Catalogues maintained by suppliers – previously maintained by hospital Consideration of vendor managed inventory (VMI)
Plymouth Hospitals NHS Trust	UK	Since 29th May 2002 with Boston Scientific	Currently have 3,000 Want to rationalise to 1,200	Increased focus on relationship. Improved information with no errors Consideration of call-off buying	Catalogues maintained by suppliers – previously maintained by hospital
Philadelphia Children's Hospital	USA	Currently undergoing trials. Owing to start trading via GHX before the end of 2002.	Concentration on strategic suppliers	As the tactical aspects of the procurement process become automated greater effort will be placed on managing the strategic elements	Consideration of vendor managed inventory Consideration of the removal of intermediaries in the procurement process.
Virtua Healthcare	USA	Since October 2001 with currently 40 per cent of all procurement spend going through this channel	Progression of ongoing supplier rationalisation program. Expressed preference for trading with suppliers who could conduct business electronically	Cessation of the use of Group Purchasing Organisations due to greater opportunities to reduce costs through collaboration (process costs) rather than economies of scale (product cost) Reduction in the number of errors on the procurement process from 15 per cent down to 8-7 per cent of all transactions	Consideration of vendor managed inventory Consideration of the removal of intermediaries in the procurement process.
Boston Scientific Supplier – Medical Devices	HQ-USA Interview undertaken in UK	Since 4th January 2002 with Leeds Teaching Hospitals NHS Trust and 28th May 2002 with Plymouth Hospitals NHS Trust	N/A	Customers pay earlier/on-time – day sales outstanding (equivalent to debtor days) reduced Reduced returns Reduced level of service complaints Multiple contact points with buying organisations Redeployment of order processing/returns staff to customer care/proactive roles	Preparation and maintenance of catalogue Increased lines/units per order – customer consolidates orders Offer of assistance to customers wishing to commence use e-marketplace
Johnson and Johnson Supplier – Medical Devices	HQ-USA Interview undertaken in UK	Since 4th January 2002 with Leeds Teaching Hospitals NHS Trust	N/A	Reduction in the day sales outstanding for buyer debt Collaboration to ensure catalogue data held by J&J and the hospital was synchronised Zero errors in the procurement process	Moving from a pull orientated supply chain to push one through the use of vendor managed inventory

representation on the board but not the executive of GHX. The mission of GHX is stated as being to,

> Simplify procurement processes in the healthcare industry by providing web-based solutions that streamline information sharing among all participants, thus driving true cost reductions into the supply chain.

In Europe, 62 hospitals (buyers) and 15 suppliers are currently using GHX. This equates to 300 trading dyads, $5.7m in transaction volume and 140,000 stock keeping units (SKU's). This is projected to grow to 167 hospitals, 31 suppliers, 1,000 trading pairs, $50m in transaction volume and 225,000 SKUs by the end of 2003.

GHX provides an electronic trading platform, which forms the electronic marketplace, between buying and supplying organisations. This platform allows the hosting of electronic catalogues of items offered by suppliers, which can be accessed by buyers and also allows for the exchange of procurement information between trading pairs. Both buyers and suppliers can interface with this trading platform in a number of distinct ways, depending upon the status of their relevant IT infrastructure and systems. The simplest means of accessing the trading platform is via a Web browser. Although this method of access offers the simplest and lowest cost means of utilising the marketplace, it has the disadvantage of not being integrated into existing information systems, and hence will require the re-keying, or other means of transferring information, from the browser to such systems.

A preferred means of utilising the marketplace is by means of integrating the user's existing systems with the trading platform. In order to achieve this GHX has developed a number of adaptors that connect the ERP systems most frequently used by buyers and suppliers with their marketplace. Increasingly the vendors of ERP systems are also developing such integration capabilities and providing them to their customers. The GHX marketplace and the connectivity with buyers (hospital) and suppliers is shown schematically in Figure 1.

The electronic product catalogues form a very important part of the GHX marketplace. These catalogues, which are maintained by suppliers, are accessed via the exchange platform by the hospitals. Suppliers are required to undertake a considerable amount of work when first joining the marketplace in order to produce a catalogue that is consistent with GHX's product description style guide. Achieving consistency of these descriptions across multiple suppliers addresses the problems many buyers within hospitals have faced to date, that of being unable to recognise the item that they wish to buy due to different descriptions being given by different suppliers and consequently being unable to easily compare the offerings of different suppliers.

GHX does not hold the prices for items within the electronic catalogues on the trading platform. Instead prices are sent directly from the supplier to the buying organisations. The reason for this is that prices are negotiated between each hospital and each supplier and consequently are described by one of the hospital managers interviewed,

> As being a sensitive issue between the hospital and each supplier.

Not holding price information within the electronic marketplace also allows GHX to provide some comfort to suppliers who are hesitant to participate due to the belief that their prices will become transparent, and hence they will be under pressure to reduce them to those of the lowest-cost suppliers.

The exchange of procurement information between the two trading parties and the role of the GHX platform in this is shown schematically in Figure 2. Following the selection of goods from the electronic catalogue, this exchange commences with a purchase order being generated by the buyer and sent via the marketplace to the supplier. The process finishes with an advanced shipping notice sent by the supplier to the buyer when the goods are dispatched. GHX does not currently support invoicing or payment activities, but is developing such services.

Study findings

In order to determine the support for the "move to the middle" hypothesis provided by the current study, the findings are presented and discussed in terms of the three constituent elements of the hypothesis, i.e. reduced supplier numbers, improved buyer-supplier relationships, and increased blurring of organisational boundaries. Examples are drawn from the individual case studies undertaken in order to illustrate points discussed. A summary of all of the six case studies undertaken, and the support which they each provide for the three elements of the hypothesis, is then presented in Table I.

Number of suppliers

Three of the four buying organisations interviewed clearly reported undertaking initiatives to reduce their supplier numbers. These supplier rationalisation activities had been commenced prior to the adoption of the chosen electronic marketplace, for example Leeds Teaching Hospital had undertaken a reduction in their supplier
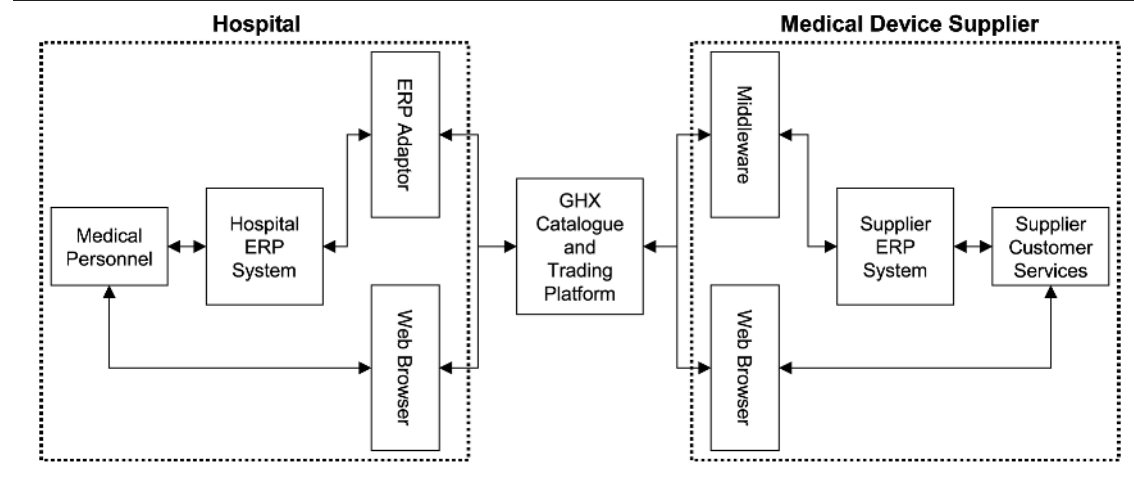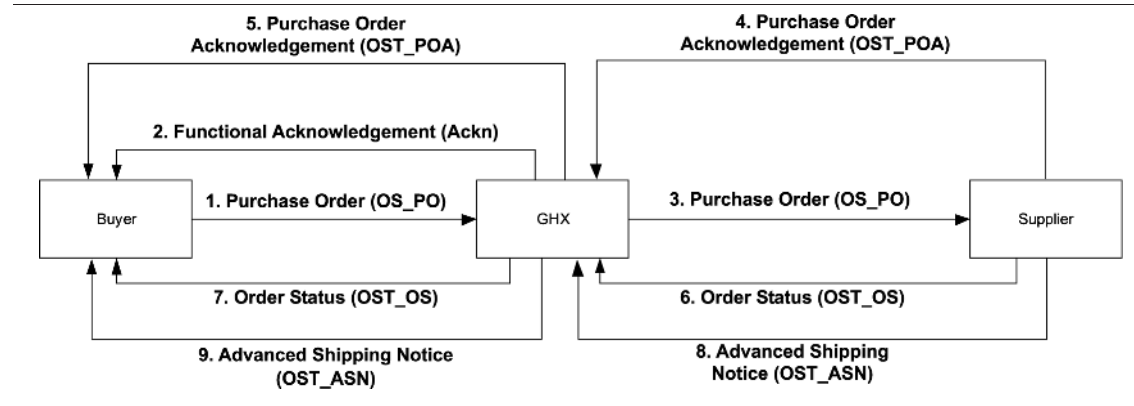
Figure 1 The GHX marketplace

Figure 2 The procurement process as via the GHX exchange platform

numbers from over 6,000 to approximately 3,000 before their use of GHX. This reduction in supplier numbers is consistent with recent trends in purchasing (Christopher, 1998). However, all of these organisations reported a desire to continue with the rationalisation of their supplier base post adoption of the electronic marketplace. This rationalisation of the supplier base will result in some suppliers losing business, but other suppliers will benefit with increased business. As expressed by the supplies manager at one of the buying organisations, the electronic catalogue which forms a major component of the GHX marketplace, rather than encourage the hospital to search for new suppliers as might have been expected from an electronic marketplace, is being used to aid in reducing supplier numbers,

> We are looking at the bits and pieces that we get from all over the place – from many different suppliers and are looking to tidy that up so that we use fewer suppliers. The on-line catalogue allows us to do that because it allows you to look at products that we are not currently aware of from our existing suppliers. Also as new products

become available from a supplier, they are immediately available to us, to order.

The process of rationalising the number of suppliers used is also reflected in the case of Plymouth Hospital. They had an objective of reducing the number of suppliers in their database from 3,000 to 1,200 and suggested that adoption of the GHX, in particular its electronic catalogue could help them achieve this objective,

> We can see whatever products an existing supplier could also supply. Some suppliers will disappear, for others the amount of business we do with them will grow.

Improved buyer-supplier relationships
Both buying and supplying organisations reported an improvement in their relationships with each other. Some of this improvement may well be as a result of the "Hawthorne Effect" (Roethlisberger and Dickson, 1939), that is the additional focus on the relationship as a result of joining the marketplace causes a temporary improvement. However, there are reasons to believe that the

improvements in the relationships will be enduring and have lasting business benefit. Both buying and supplying organisations reported a reduction in errors in the orders placed via their e-marketplaces, compared to their pre-existing procurement procedures. One organisation estimated that around 60 per cent of all orders resulted in queries due to prices, product codes or order quantities. For this organisation, trading via the electronic marketplace had ,to date, led to 100 per cent error free trading. This reduction in errors has directly resulted in an improved relationship with their trading partners,

> Our relationships with suppliers are so much better – often we didn't have a relationship before. We used to shout at each other periodically about payments and things. But now we get it right first time and can move on to build relationships.

Another supplier develops this line of reasoning by confirming the importance of accurate and timely data in improving the buyer-supplier relationship,

> The single most important thing about our relationship with suppliers is clarity of data. After that a better working relationship is developed.

In addition to allowing the development of improved relationships, use of the electronic marketplace offered additional benefits to both buyers and suppliers. By expediting the procurement process, particularly through reducing the delays caused by order errors and queries, the suppliers interviewed reported that they received payments promptly, and hence were no longer effectively funding debt in the form of outstanding receivables as they had been doing previously. The suppliers were also pleased to be able to pay on time as they recognised that prompt payment is an important part of effective SRM, and also did not wish to be considered as having an unreliable or poor payment record.

Prior to the adoption of the electronic marketplace the majority of orders from the buying organisations studied were placed by telephone and autofax. One supplier organisation studied stated that approximately 65 per cent of their orders were taken via the telephone and that they had seven staff dedicated to order processing and query handling. Integrating GHX with their order processing and ERP systems would remove the need to handle incoming calls and rekey information. The supplier is currently exploring the opportunity of redeploying their order handling staff in a customer care role. The increased number of staff in such roles is expected to significantly improve relationships with buyers. A change in the nature of the staff involved in the buyer and seller relationship has already been witnessed by one of the buying organisations,

> We used to only see sales people – we don't now. Their customer services manager is absolutely critical to the relationship. We make sure he is present – but that is no trouble as he wants to be – so that they understand the supply chain issues and how we can improve trade between ourselves.

Contact has also been established between buyers and suppliers at multiple levels in their organisations, including the most senior levels, and has increased face to face interactions,

> We had the President of [supplier name] sitting in this chair here. I think it was the first time out of Paris for something like this and I think it was quite a culture shock coming to see us. When we showed him what we are doing and he really grasped the potential.

The theory of inter-organisational relationships has shown that multiple-level and multiple function linkages between firms is an important factor in developing enduring relationships (Christopher and McDonald, 1995). Such theory also identifies the importance of inter-personal relationships as an antecedent of inter-organisational commitment (Wilson and Mummalaneni, 1986; Wilson, 1995; Mavondo and Rodrigo, 2001). Indeed Rylander *et al.* (1997) stress that "much commitment occurs at a personal rather than organisational level". Improved face-to-face communication may be expected to improve inter-personal relationships and hence contribute to improved inter-organisational commitment. Personal traits may be expected to be important in developing effective inter-personal relationships. In the case of adoption of new systems, such as e-marketplaces, a personal willingness to try new ways of working amongst the key staff who would be involved was recognised as being important,

> A lot of hospitals are very traditional and don't like to change the way they operate. The people at [hospital names] are not like that. They are willing to look at change and the implications of their decisions on the broader supply chain – these guys are slightly different to standard healthcare people.

Increased blurring of organisational boundaries

The "move to the middle" hypothesis suggests that the greater use of IT to undertake inter-firm transactions will be accompanied by a blurring of the organisation's boundaries. Perhaps due to the relatively short period of use of the e-marketplaces by the organisations interviewed, there was less compelling evidence to support this element of the hypothesis. In the case of the UK based hospitals interviewed, prior to the use of the GHX marketplace, the hospitals themselves had maintained their own electronic record of the products they purchased. This involved them

contacting each supplier regularly for updated product information resulting in a considerable amount of work for them. Use of the GHX marketplace requires the suppliers to maintain an up to date, standardised electronic product catalogue, which any hospital can then access. Although this may not represent a significant shift in the boundaries of the two organisations, it does represent considerable time savings for the buying organisations that were maintaining such catalogues previously.

Initiatives which the organisations interviewed are currently exploring, and which represent a greater degree of blurring of organisational boundaries, include vendor managed inventory (VMI), also termed co-managed inventory (CMI). In such cases, suppliers monitor the level of stocks of their products held by the buyer, and are responsible for re-stocking when necessary. Whilst such schemes may often have disadvantages for suppliers in terms of when goods are paid for, they usually allow a deeper and more lasting relationship with buyers to be established (Christopher, 1998) and are therefore of considerable interest to suppliers. VMI schemes rely on the rapid and accurate transmission of inventory data from the buyer to the supplier and are therefore well suited, if not reliant, on electronic linkages such as e-marketplaces being adopted by organisations. One supplier described this in terms of,

> I think it will be about push instead of pull. From a product requirement perspective the hospital has to place orders on us. In the future I believe the technology will enable suppliers to know a hospitals usage and be able to push a product on them in a timely manner, without them having to place an order.

Interestingly, the evidence found to support the increased blurring of inter-firm boundaries suggests that this may not be limited to activities being transferred from buyer to supplier, but that there may also be activities previously undertaken by the supplier that are transferred to the buyer. A number of the buying organisations described a reduction in the number of separate orders placed with the supplying organisations, thereby effectively providing a consolidation service for them. For example, Leeds Teaching Hospital described a reduction in the number of orders placed with a major supplier to their catheter laboratory. Prior to using GHX they placed 16 orders a week with the supplier. This was reduced to two orders per week after adopting GHX. Consequently this reduced the number of times stock was picked by the supplier, and the number of deliveries made by the supplier to the hospital by a similar order of magnitude.

Further initiatives by other buyers are being investigated to further consolidate orders, for example across different hospital sites. Although this would provide transaction processing savings for both parties, it is likely to increase the complexity of inbound logistics for the buyers. However, they were confident that a co-operative solution could be found that would be of benefit to both parties,

> I have an email here inviting us down to [supplier name]. One of the things we are looking at is consolidating the orders with them, so that we could send one order for our different hospital sites and make it much easier for them to invoice us. So, what we could do is go out and have a look at their systems and see for instance at the point of pick, could they put a bar code on the box that tells us where it wants to go in the hospital and make it easier for us to bring things in. There are enormous savings to be made for both sides from this.

Summary and discussion

This study has sought to explore the impact of e-marketplaces on the relationship between buyers and suppliers. In particular it seeks to determine if the "move to the middle" hypothesis put forward by Clemons *et al.* (1993) will be supported in this domain.

E-marketplaces have been heralded as allowing buyers to find new suppliers more easily, compare their offerings and if appropriate switch between them. In contrast to this prediction, this study has found that the adoption of an electronic marketplace in the healthcare sector had led to a continuation in the trend to reduce supplier numbers. We do not suggest that electronic marketplace adoption is the driver of supplier rationalisation. Such rationalisation has been identified as part of good procurement practice for some time (Christopher, 1998) and in the organisations studied, steps to reduce supplier numbers had been undertaken prior to, and independently of, electronic marketplace adoption. Indeed, the National Health Service in the UK, of which both Leeds and Plymouth Hospitals studied are a part of, has formally recommended a policy of both supplier and product rationalisation to its hospitals (Cabinet Office, 1998). However, a finding of interest in this study, and which is counter-intuitive given the ability of marketplaces to allow buyers to more easily access many suppliers, is that use of the marketplace did not encourage buyers to search for and use new suppliers, rather it encouraged and even aided the continuation of a reduction in supplier numbers.

The fact that GHX has been established by a consortium of suppliers, rather than buyers, may have encouraged the development of a marketplace that favours a "move to the middle" rather than a "move to the market". For example, the lack of prices for goods on the marketplace prevents buyers using the marketplace to compare suppliers on the basis of price alone, a behaviour that is most likely to lead to increased switching between suppliers. Rather, the emphasis of the marketplace on the removal of error-prone and time-consuming steps in the procurement process, hence reducing the transaction cost element of the procurement process.

The cases of the buying organisations considered in this study clearly suggest that use of the electronic marketplace has led to a continuation of supplier rationalisation. For example, buyers described examining the electronic catalogues of their existing, preferred suppliers to determine if they offered products that the hospital was buying from other suppliers. However, it should be recognised that a reduction in supplier numbers may be observed in other industry sectors for reasons unrelated to the adoption of e-marketplaces. Reasons may relate to the suppliers in the industry, such as a consolidation of those suppliers, as recently witnessed in the pharmaceutical industry or increased regulation of suppliers at either a national or industry level. A decrease in supplier numbers may also relate to the nature of the product being bought. Increases in product complexity or asset specificity, suggest a reduction in the number of suppliers that buyers can draw upon to meet their exacting requirements (Malone *et al.*, 1987).

Rather than replace human relationships as may have been expected, the establishment of electronic communication between organisations in this study has resulted in increased person-to-person communication. The quality of personal communication has been found to have improved, moving from a concentration on disputes to the exploration of co-operative initiatives, and has also been found to be occurring at multiple levels between organisations. This is an important finding since improved inter-personal relationships have been recognised in the relationship theory literature as an important antecedent of improved organisational commitment (Wilson and Mummalaneni, 1986; Wilson, 1995; Rylander *et al.*, 1997; Mavondo and Rodrigo, 2001).

The observations of reduced supplier numbers and improved relationships are consistent with the "move to the middle" hypothesis of Clemons *et al.* (1993) and contrary to the "move to the market" hypothesis of Malone *et al.* (1987). Clemons *et al.* also suggest that the increasing adoption of inter-

firm IT systems will result in an increased blurring of firm boundaries. Only relatively simple examples of increased outsourcing as a result of the use of the electronic marketplace have been witnessed in the current study. The organisations interviewed are considering new initiatives in this area, such as VMI and it may be expected that further initiatives will be developed as the use of e-marketplaces grows. Marketplaces in sectors such as electronics, automotive, aerospace and retail are currently addressing activities such as collaborative new product development and promotional campaigns, which lie across the boundaries of the participating firms.

The findings of this study have important implications for all those involved in e-marketplaces, or considering participation. To date suppliers have been reluctant to participate in marketplaces due to the belief that they will be compared to their competitors on the basis of price alone. The concentration of some marketplaces on auctions has exacerbated this perception. The difficulty of supplier recruitment has rendered many marketplaces unviable and has contributed to their closure. Studies such as this indicate that some buyers are looking to e-marketplaces to improve the relationships with a smaller number of key suppliers. Suppliers should be made aware of this emphasis on long-term relationships, both by the marketplaces themselves and the buying organisations.

Fontenot and Wilson (1997) propose a range of possible buyer-supplier relationships shown in Table II. The possible relationships form a continuum from discrete transactions on the left-hand side to vertical integration on the right-hand side. Table III lists some of the constructs associated with buyer-supplier relationships that have been identified in previous studies. All of the constructs identified in Table III increase as the relationships shown in Table II develop from discrete transactions to more dependent relationships shown on the right. Table II is used to indicate how the use of GHX might be considered as developing the nature of the relationship between the buyers and suppliers interviewed. Prior to the adoption of GHX, the medical devices provided by the suppliers were purchased by the hospitals under long-term contracts, typically of a year or more in duration. These contracts resulted in repeated transactions with the suppliers, but as the case studies showed, these transactions did not result in high quality relationships. Adoption and use of GHX resulted in an increased degree or incidence of one or more of the relationship constructs shown in Table III, and hence the use of GHX can be considered as moving the buyer-suppliers along the relationship

Table II Continuum of buyer-supplier relationships

Range of possible relationships	Transactions	Repeated transactions	Long-term relationships	Buyer –seller partnerships	Strategic alliances	Network organisations	Vertical integration
Importance/ degree of relational constructs shown in Table III	Low						High
Impact of GHX on buyer-supplier relationships		Prior to GHX adoption – long term contracts resulted in multiple transactions	Subsequent to GHX adoption – development of improved relationships, e.g. increased inter-personal contact and co-operative approach to problem solving	Future Potential for joint initiatives, e.g. new product development			

Table III Buyer-supplier relationship constructs

Buyer supplier relationship constructs	Previous studies
Co operation	Fontenot and Wilson (1997)
Collaboration	Bakos and Brynjolfsson (1993)
Trust	Morgan and Hunt (1994)
Interdependence	Vlosky and Wilson (1997)
Specific investment	Simpson and Wren (1997)
Switching costs	Simpson and Wren (1997); Smith *et al.* (1997)
Co ordination	Malone and Crowston, 1994
Multiple level/functional interaction	Christopher and McDonald (1995)
Inter-personal relationships	Wilson and Mummalaneni (1986); Wilson (1995); Mavondo and Rodrigo (2001); Rylander *et al.* (1997)
Power	Fontenot and Wilson (1997)
Communication and conflict resolution	Mohr and Spekman (1994)

continuum. In the future, increased depth of those relationships, perhaps aided by the development of new services by the marketplace itself, may allow these long-term relationships to mature into the next stage identified by Table II, that is buyer-supplier partnerships. Such partnerships may be used as a means of establishing collaborative working, for example the verification of the safety and efficacy of medical devices and new treatment regimes.

Limitations to current study and future research directions

The current study has been exploratory in nature and hence small. The wish to study buyer-supplier dyads resulted in a focus on a single sector. However, the findings may not necessarily be generalisable to other industries, since there may be individual factors, or a set of factors in combination, that are specific to the healthcare sector that result in a "move to the middle" when adopting e-marketplaces. Such factors may include the services nature of healthcare provision, the external regional or national controls guiding the operation of public service organisations such as hospitals or the not-for-profit, non-competitive nature of some organisations in this sector, particularly those healthcare providers in the UK.

Additional studies should be undertaken to determine if the support for the "move to the middle" hypothesis is found in the adoption and use of e-marketplaces in other industry sectors. Differences in the degree to which distinct industry sectors provide support for this hypothesis could then be explored in terms of the nature of those industries. Such studies would provide the first stages of a more fundamental exploration of the relationship between a key element of strategic analysis, industry structure (Porter, 1985) and electronic marketplace adoption and evolution.

The current study addressed items that were purchased with relatively long-term contracts, which is referred to as systematic sourcing by Kaplan and Sawhney (2000). Establishing good relationships between buyers and suppliers may be expected to be important for such buying arrangements. Further studies should consider the impact of e-marketplaces on buyer and supplier relationships in the case of spot sourcing, where such long-term contracts are not in place.

As e-marketplaces mature and their usage grows, they will provide the opportunity for longitudinal studies to be undertaken. Such studies will establish if the changes in the dyadic relationships observed in this study are enduring. They will also provide the opportunity to further explore the development of activities and processes that existing inter-organisational relationship literature suggests will yield the greatest benefits to both parties. These are the activities and processes that are shared between the two organisations and hence which contribute to the increased "blurring of the boundaries between the trading firms".

Tables II and III present a continuum of buyer and supplier relationships and their associated constructs. Whilst there is a considerable body of literature that addresses the nature such relationships and their underlying constructs from a marketing perspective, significantly less research has been undertaken on the impact of electronic trading on these relationships. The majority of electronic trading systems have been adopted by established trading buyer–supplier dyads, typically representing points in the middle of the continuum shown in Table II. E-marketplaces offer the unique ability to provide linkages at the extremes of the continuum, that is, between firms that were previously unknown to each other whilst also supporting collaborative strategic activities such as new product development. The electronic marketplace domain would therefore provide an interesting field in which to explore the "polar extremes" (Eisenhardt, 1989) of buyer-supplier relationships, and how electronic trading can move companies between these extremes, and hence enrich our understanding of this important and dynamic domain.

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Other papers
Integrating diverse ERP systems: a case study

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Abstract

Enterprise resource planning (ERP) went through many development cycles since its beginning in the 1970s until it established itself as a backbone of most major enterprises in the world. In spite of its countless advantages, most ERP implementations require heavy customisation to achieve their proclaimed advantages. This paper represents an endeavour to investigate, through a case study, the feasibility of minimising the heavy customisation required by most ERP implementations by selecting the best modules from each vendor and integrating them using enterprise application integration technologies, to form one (integrated) system. In doing so, the paper provides a description of a way to implement a suggested integrated solution, as well as a discussion of how minimising customisation enables enterprises to upgrade their ERP software effortlessly and cost-effectively.

1. Introduction

An enterprise resource planning (ERP) system is an attempt to create an integrated product that manages the majority of operations in a company. It is defined by Scott (2002) as: "a suite of integrated corporate wide software applications that drives manufacturing, financial, distribution, HR, and other business functions in a real time environment". In the past, organisations used separate applications to automate these business functions. What is different about ERP systems, is that they integrate across functions to create a single, unified system, rather than a group of separate, insular applications.

ERP software is the backbone of many big enterprises in the world today. The purpose of ERP is to provide organisations with a single-point solution, thus integrating all the core back office business activities such as: inventory, logistics, finance and human resources (HR), into one system. Having a single integrated system increases the organisation's efficiency by eliminating many redundant activities that might be required to keep different systems synchronised and this leads to great reductions in the operating costs. Despite some problems such as: long implementation periods and mass customisations required, ERP is "a necessity" for organisations to survive in today's competitive market. Following advice from Business Consultation Groups and ERP vendors, organisations try not to mix the components of different ERP products to avoid integration difficulties. The implication of following this strategy is that, enterprises are tied to a single ERP vendor who might influence and dictate its prices and technologies. In addition, a bigger disadvantage is losing a vast amount of supplementary benefits that might be provided by the other ERP vendors/products, which are not considered in the first place. As an example, suppose that a company realises that SAP ERP would better suit its requirement in most areas except for HR in which another product, such as Oracle, may be superior. At present, the company will most probably choose to sacrifice the important area of HR and select SAP for all its modules, including HR, therefore, losing all the additional functionality provided by the other vendor. As such, the company would then have to be engaged in lots of costly mass customisation for the SAP HR module to comply with its requirements. Recently, academic and business studies (Irvin, 2001; Steadman, 2000; Themistocleous *et al.*, 2001a, b) have concluded that ERP vendors were not able to satisfy the Information Systems (IS) requirements of their clients. As such, companies are now looking for

solutions to fill in the gaps left by their preferred ERP products.

2. Problems with ERP systems

There are many problems associated with ERP solutions. For a start, the word "Enterprise" in ERP refers only to the back office, hardly the whole enterprise. Nonetheless, ERP is still big enough to force lots of companies to do things very differently and that can prove difficult for large organisations as sometimes, it may require a radical change in their business processes (Lee, 2002). As reported by Mc Vittie (2001), anyone who has attempted to change business procedures even slightly knows that this is "painful". This is in accordance with published literature on this area such as Davenport (1998) and Sumner (1999) who support that ERP customisations is a difficult task. Therefore, in deciding for an ERP solution, organisations must first determine if their traditional business practices would be able to fit within a standard ERP package.

Then, there is the issue of data accuracy. Forget how robust a given system can be; if the data that go into the ERP system is not accurate or immediately accessible, the whole system becomes suspect. The catalyst for an ERP system may be a company's need to survive, but the success of ERP is predicated on the simple concept of collecting accurate, timely data. In the absence of reliable data, ERP is deficient at best, a failure at worst (Scott, 2002). On the other hand, some enterprise applications make life so difficult by complicating even the simpler of processes. For instance, a simple data collection task in an enterprise software application may require from three to eight screens for the user/administrator to fill-in a few relevant fields of data.

Finally, like all other IS projects, ERP implementations have a high risk of failure and may drift. According to the Conference Board survey results, reported by CMP (2001), approximately 40 percent of participants failed to achieve their business goals after having implemented ERP projects for at least 12 months. The report mentions that the most difficult support tasks were: incorporating business process changes, upgrading software products, supporting gap solutions, and adding new functionality. It must be noted that 20 percent of the survey participants decided to terminate their ERP projects entirely.

While most ERP vendors offer various forms of support for enterprise business needs, some are more successful in one area over another (Mc Vittie, 2001). Several vendors are better at providing solutions for financial processes rather than for the manufacturing ones. The authors therefore encourage a simple question: "Why do not we select the best tools from each vendor and integrate them into a single system?" Easier said than done, the answer was rather confusing until recently; but with the advent of enterprise application integration (EAI) tools, it is now possible to provide a sophisticated and feasible solution. In this paper, the authors argue that there are many benefits to be realised from the integration of ERP components and they provide an example of integrating the modules of two ERP different systems.

3. The need to mix ERP components

Generic enterprise systems solutions are fading from the scene. The rush to spread ERP systems to more organisations is driven by the prospect base. Executives in industries say that generic products require longer implementations, more workarounds, and increase the complication of add-on solutions (Ramanathan, 2000). There is little doubt that vendors of collaborative enterprise suites, have to address the market on multiple fronts to satisfy all different needs. According to Mann (2002), a CIO at a leading UK organisation says: "We looked at a number of ERP solutions and they just didn't fit our aviation; what we do is very different from manufacturing; it's a lot more variable and complex. The manufacturing-based ERP solutions don't have the flexibility to tie all our business processes together".

To properly balance and align real-world business processes with ERP functionality, executives and ERP teams have to engage in an important process known as "Gap Analysis". Gap Analysis is critical not only to determine the overall ERP implementation strategy, but also to pinpoint the integration requirements for the ERP system. The exercise forces thorough inspection of the processes used to collect and move mission critical company data to an ERP system. Gap Analysis is defined by Scott (2002) as the evaluation of the functions provided by the system, compared to the operational processes necessary to run the business. The area, where software does not cover functions and operational process requirements is known as the "gap". The gap requires executives and ERP teams to proactively take a few crucial steps:

(1) examine a business process to match an ERP function;
(2) enhance the business process to meet the needs of the desired ERP system outcome;

(3) employ integration software to bridge the gap; and

(4) determine if it is necessary to add a custom bolt-on applications for a critical function that the ERP system does not address.

While ERP software was designed to standardise a range of business processes, each installation typically required extensive customisation to reflect a company's unique procedures and situation (Marti, 2000). So, customisation and adding bolt-on applications to an ERP is a very widespread practice. According to a survey performed by Callahan (2002), when asked how their ERP solution perform, before adding any bolt-ons, or enhancements, nearly 77 percent felt that their system was average or below average. This is also in accordance with previous literature on this area (Themistocleous *et al.*, 2001b). An interesting side note is that 31 percent of the survey respondents said that they use more than one ERP application. When questioned about this in more detail, the answer seems logical: mergers and acquisitions were a major cause. Fifty percent of the companies responding to the study indicated their IT teams accept the concept of adding bolt-on applications to make up for the shortfalls of the ERP application. The *gaps* in the ERP systems are being addressed primarily through outsourcing bolt-on modules from third party vendors.

The above four steps described by Scott (2002) and the bolt-on concept by Callahan (2002) are the industry practice to-date. In this research paper, steps three and four above are both utilised by taking the relevant parts of a certain ERP system and patch the gaps with modules from different ERPs instead of mass customization or costly bolt-on applications. An EAI solution is used to integrate the different ingredients together. The concept which the authors introduce with this case study might not be totally new in the industry, but this research provides an opportunity to investigate the feasibility of this option in a scientific manner.

4. Case study and data collection methods

The case organisation, which will be referred to by the fictitious name of S-Tel, is a leading telecommunication company in the Middle East. It formally commenced operations in July 1981 to provide and maintain telecommunications services in the region. Over the ensuing 20 years, S-Tel has built up a well-deserved reputation as a regional telecommunications hub in the Middle East. Today its vision is far more ambitious, dictated not only by the dramatic growth of technology, but by

other equally potent factors such as globalisation and deregulation which are the main challenges to be faced. S-Tel's aim is to be a world-class company providing integrated solutions as part of a customer-focused strategy. The scope of its business today covers the areas of voice and data transmission, fixed and mobile telephony and content and delivery.

The purpose of introducing this case study was to define a problem area and recommend a solution. In doing so, several data collection methods were used; mainly interviews, observations and document sampling. The interviews were of semi-structured nature and they were the main source of information. They were conducted with the project manager and the team members responsible for analysing and implementing the system as well as the support staff who were stakeholders in the project. The team consisted of IS specialists and super users from different function areas. The observations were recorded by spending some time watching the project activities in different project stages, especially during the initial ones. The authors were also given access to the project shared drive, which utilises a knowledge management repository shared among team members and contained most of the project documentation. Samples of some documents were taken and used as supporting material for this research. The data and facts included in this paper were obtained using the above methods.

4.1 Problem definition
The IS department at S-Tel is responsible of investigating and providing solutions that satisfies all the departments and supports future needs. In order to catch-up with technology, S-Tel started to replace most of its legacy systems with new off-the-shelf software packages. The legacy back office systems consisted of more than 20 loosely integrated systems. Some of the applications had not been developed proficiently, lacking proper documentation, hence making them hard or even impossible to control, maintain and support. Data integrity, consistency and security were not guaranteed. In addition many of the systems were stand-alone (e.g. not integrated); thus, a lot of work was wasted for data re-entry.

Therefore, S-Tel decided to start a project to replace all these systems with a single "best-of-breed" integrated solution. The primary project objective was to provide a fully integrated back office solution to enable the company to improve its processes, support the business more efficiently and effectively and to produce timely and accurate information relevant to the competitive business environment.

The most notable critical success factors of this project were:

(1) *Centralised database.* The new systems should provide a central database for all information with proper control and validation of all data elements. This should eliminate duplicate and redundant data maintained at different levels thereby ensuring data integrity and quality.

(2) *Manipulation.* All information should be accessible for end users to manipulate and report based on different security levels to different authorised personal.

(3) *Real time access.* Real time access to relevant business information is vital for decision-making. The systems should enable users to generate the required information easily and on a timely basis.

(4) *Automate business functions.* The system should, where possible, automate business functions and workflow so that human intervention is reduced.

(5) *Paperless environment.* The system should support a paperless environment.

(6) *Avoid customisation.* The IS strategy was to avoid customisation as much as possible in order to ease future upgrades to the new versions of the software.

After a thorough investigation of the market, supported by many site visits, the IS department along with the business owners reached the decision that the SAP R/3 suited their back office activities including: manufacturing, planning, finance and logistics. However, it did not suit HR, an area with the greatest number of problems in the back office legacy systems. The mismatch was mainly due to the functional gaps in SAP and other requirements such as:

- HR had urgent problems that needed to be resolved as soon as possible. The SAP implementation would normally take between three and five years. Meanwhile, a solution for the HR was required in 12 months

- SAP R/3 did not offer bilingual support. The HR department requires support for the local language as it is the primary one used for most HR reports and letters.

- The HR department needed a thin-client configuration which would support remote access to their systems which was not offered by SAP R/3 at that time.

- The payroll module was very complex and it was a common feeling that SAP would not satisfy S-Tel's ever-changing needs because of the rigid nature of SAP.

The IS department had three choices

(1) customise SAP R/3;

(2) add bolt-on applications; or

(3) implement the HR module of Oracle applications ERP integrated with SAP R/3.

The latter (option) was the most feasible in terms of cost and functionality. Therefore, the HRMS module was selected from Oracle applications for its flexibility to suit all HR and Payroll function areas. Figure 1 shows the back office activities at S-Tel. The function areas in the upper shaded box represent all back office activities except HR and payroll, which are represented by the lower box. The entire activities in the lower box can be replaced by one process in the ERP structure.

4.2 HR applications

HR applications such as payroll, personnel and applicant tracking systems are extremely hot in today's ERP market. Organisations are realising that, their employees represent their most valuable assets, and they are investing (more than ever) in systems to help them provide better support to their employees. Companies are also looking for creative ways to examine and evaluate their businesses. As a result, management reporting functions with a

Figure 1 The back-office activities at S-Tel
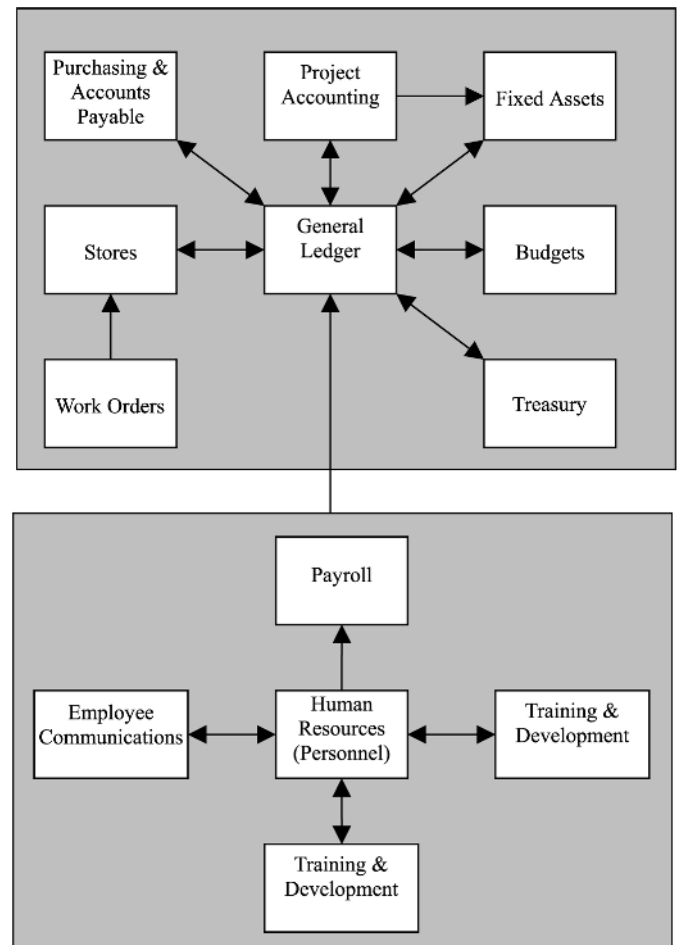
focus on areas such as hiring trends and turnover analysis, are taking on greater importance in the process of managing large organisations.

In addition, government reporting requirements continue to evolve. It is difficult for ERP vendors to keep up with these changes and even when they can, it is a burden for customers to regularly install and configure software updates. Vendors are increasingly looking to provide their customers with the ability to do ad hoc analysis and custom reporting against their HR data so that corporations can be more flexible and responsive to their changing reporting needs. However, providing complex report-writing tools to run against sophisticated ERP data models is not an ideal solution. These tools require an in-depth understanding of the underlying data model, which a typical HR analyst will not possess. As a result, many companies use their MIS organisations as a channel for creating new reports. This can work quite well, but in organisations, where MIS is resource-constrained, this often leads to bottlenecks. Once again, companies are looking to ERP and database vendors to address these challenges in a turn-key fashion. Oracle is one of the few ERP vendors who designed its HR module in such a flexible way that the end users have the ability not only to use the system; but also to develop their own reports and configure some parts of the system, such as payroll elements, by themselves.

4.3 S-Tel IS steering guidelines constraints

Any S-Tel project that is undertaken by the IS department has to follow certain steering guidelines in order to get a proper balance of all variables in the project such as: cost, quality and time. The guidelines identified by the technical working group are:

- *Leverage existing investment in IT.* S-Tel requires the new technology architecture to utilise the existing investment in IT. Accordingly, the new technical infrastructure for the HRMS solution should seek to build on the existing IT hardware components and organisational skills.
- *Industry-standard and proven architecture.* S-Tel requires the new technology architecture to be based on leading and mature technologies in the areas of hardware, system software, databases and business applications.
- *Shared and centralised application services.* S-Tel has a strategic direction to deploy a shared and centralised application service model. The model aims to reduce the IT support overhead and increase information sharing by using the Web and Internet technologies. System users should be able to access business applications through an Internet browser without the need

to install further software on their client workstations.

- *Adequate system performance.* S-Tel has strict quality requirements in terms of the new HRMS solution response time, availability and recoverability. These requirements are intended to ensure that key system users have an acceptable and adequate level of service.
- *Integration with existing applications.* S-Tel requires the new technology architecture to be based on open standards, which facilitates the future integration with existing applications. This includes back office applications (e.g. financial system), workgroup software (e.g. Lotus notes) and external systems (e.g. banks).
- *Good balance of architecture characteristics.* S-Tel requires the new technology architecture to provide a good balance of the standard characteristics of performance, scalability, availability, maintainability and cost-effectiveness. S-Tel had set the priorities below for the selection of its future technology architecture. The set priorities were primarily driven by the nature of the HRMS solution being a back office, non-mission critical, administrative system and were identified after a careful discussion between S-Tel's technical working group with one of the authors' attendance (Table I).

4.4 The recommended solution

As mentioned above, S-Tel took the decision to implement Oracle HRMS within a SAP R/3 ERP suite. The basic components of R/3 were found sufficient to cover all the function areas shown in Figure 2; these were logistics, financials and planning. On the other hand, Oracle HRMS module was used to replace all HR, payroll and

Table I S-Tel IS steering guidelines priorities

Selection priority	Rationale
First priority: cost effectiveness	Since the HRMS solution is a back office administrative system, hardware investment need to be tightly controlled and clearly justified
Second priority: maintainability	Low maintenance and support cost is a key driver behind the centralised shared services model targeted by S-Tel
Third priority: performance	Since the HRMS solution is a back office administrative system, there will be no compelling need for superior performance
Fourth priority: availability	Since the HRMS solution is a back office administrative system, system failure will have low impact on S-Tel's business continuity and service delivery capabilities
Fifth priority: scalability	The initial configuration of the system will consider S-Tel's operational requirements for the coming five years

Figure 2 The recommended solution
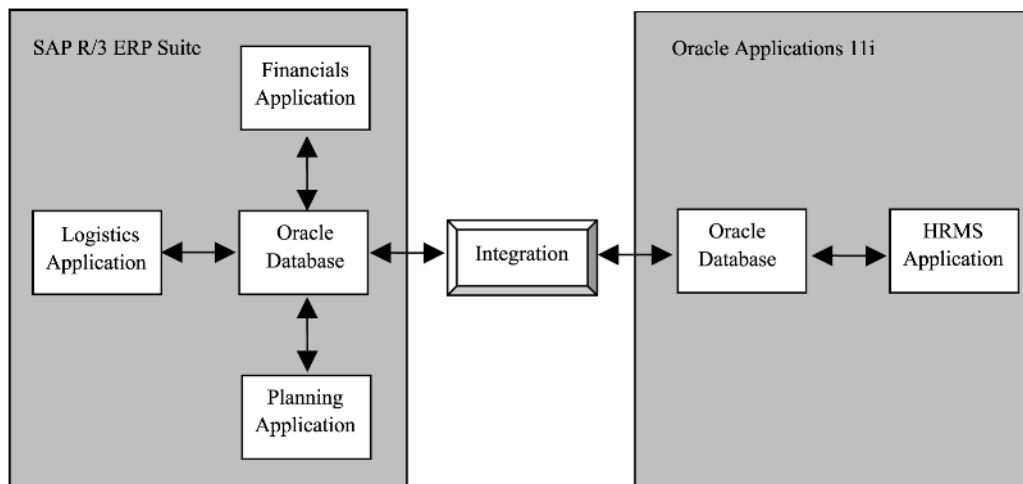
training activities. Figure 2 shows the final product, with all the different components.

The two shaded boxes represent SAP and Oracle systems. The clear boundaries that separate all modules make the diagram look very simple; however, the underlying architecture is very complex. Some of these modules are composed of more than a dozen subsystems. Although both SAP R/3 and Oracle applications are based on Oracle database, it proved necessary to keep them separate and link them using an integration tool. This was judged as the best way to make the architecture flexible. Using EAI technologies with separate databases provides an infrastructure to add and subtract modules very easily. Furthermore, it helps combining or separating the platforms. The design enables S-Tel to implement the two systems separately and link them afterwards upon completion and proved essential as the critical HR functions (implemented using Oracle HRMS) needed to be ready within 12 months after project initiation. On the other hand, implementation of the SAP modules started at the same time but will require at least three years to go live. Therefore, Oracle would be linked to the legacy back office systems during the SAP implementation; that should not be a problem once the link is established as it is easy to switch between different systems. However it could cause a problem if the company decides to change its chart of account, which is very unusual in well-established enterprises.

4.5 Selecting integration technologies
S-Tel chose to acquire and implement a proven, highly functional and scalable solution to augment its enterprise integration strategy. Any integration solution purchased by S-Tel should help meet the short- and long-term goals of integrating all systems into the enterprise and help improve organisational performance. In order to select an EAI tool, S-Tel considered a list of vendors against a fixed set of criteria. An original long list of seven integration-tools vendors was compiled. This long list was reduced to three by an initial evaluation exercise. The three short-listed vendors were: IBM, TIBCO and Microsoft. Several criteria were identified as critical for S-Tel's requirements and each vendor was evaluated against them, in an attempt to ensure that the final selection process will not be flawed because of inconsistent data. At the end of this process, S-Tel decided to go for IBM's MQSeries because it had the greatest score overall.

4.6 Building the integration link
Building the integration link between Oracle HRMS and SAP GL required three main steps: extract data from Oracle HRMS and SAP GL, build adapter for both systems to enable data being passed, format the data based on the adapter and upload data into the two systems. More than 80 percent of the effort was spent on building the adapters. The adapters were used to interface the integration tool with the variety of applications on differing platforms. The interfaces convert the native data formats and procedures of the applications into a common structure that is then utilised by the integration technologies provided by the vendor. The architectural theme is that, the functions that are common to all integrations (networking, queuing, security, etc.) need to be built only once. The custom coding part of the job was reduced to just providing the interfaces. Meanwhile, EAI vendors offer a selection of previously built adapters for most of the popular applications likely to be found in an enterprise. If an adaptor is available, the job will consist primarily of implementing particular data

structures and business logic peculiar to the enterprise, often with GUI based tools that require no detailed programming. On the other hand, if no adaptor exists one will have to be developed as part of the integration effort. The vendors have prototypes, templates and established procedures for how these developments can be accomplished, and hence the risks in general are not something to become alarmed about. But these efforts do take time and are likely to contribute significantly to the duration of the project.

Fortunately, IBM's MQSeries integrator provides adapters for Oracle applications and SAP R/3. This reduced the need to extract of Journal entries from Oracle payroll and passing it to the Oracle's adapter which (in the future) uploaded into SAP using SAP's adapter. There will be no extract from SAP to Oracle because the interface is one way only. Integration can be synchronous or asynchronous. Synchronous integration between systems requires all system to be online at the time of communication. However, it is difficult to make all systems synchronised at all times; and thus, it is preferable to use asynchronous integration. MQSeries is an asynchronous integration tool; and this means that the integrated systems need not be online at the time of communication. Figure 3 shows the way MQSeries passes the messages between Oracle and SAP in S-Tel's implementation.

MQSeries simply gets the message from Oracle and stores it in a messaging server; which in turn passes it to SAP. Since there is no message passed from SAP to Oracle, the communication will be one way in that case. MQSeries messages consist of a header and a body. The header works as a controller to identify the applications being communicated. The body is simply the data to be passed; and in this context it is the general ledger interface details. The general ledger interface aims to reflect the financial impact of the human resource transactions to S-Tel's financial system by means of "Journal Vouchers". Oracle HRMS application has built-in features to calculate payroll costing and generate "Journal Vouchers" to be used by the enterprise financial application. A custom-built program based on PL/SQL and other programming languages, if necessary, will be used to extract the data from Oracle payroll. The script should perform the following tasks:

- Read payroll costing data and journal vouchers from Oracle HRMS tables.
- Process the costing information as per S-Tel's functional requirements.
- Develop corresponding journal vouchers for later entry into S-Tel's financial system (e.g. SAP GL).
- Validate the developed journal vouchers by means of checksums and totals.
- At the end, the script should store developed journal vouchers in a text file or table.
- The interface should also have a "Replay" mechanism in order to re-generate the journal vouchers upon system crash.

The main fields of a journal entry include: transaction date, profit centre, natural account code, product code, project code, description, debit amount and credit amount.

4.7 Activating and using the link

In order to make the link usable, the following procedure should be followed by the Payroll Administrator or the Super User. Processes 1-4 are standard and provided by Oracle for every implementation. They can be executed from submit processes and report form.

- Run the payroll process to distribute the payroll elements to the staff.
- Run message report and make sure that no errors exist. Otherwise, fix the problems and re-run the payroll process.
- Run the pre-payment process to distribute the amounts to the different payment methods defined in the system.
- Run the costing process to generate the Journal entries.
- Run GL Interface from the same form as the above processes. However, this process is a custom-made process to create the Journal entries on a Unix text file based on the format required by the Integration adapter.
- The Oracle's adapter of MQSeries will automatically capture this file and move it to the SAP adapter which in turn copy it to the SAP files.
- The SAP GL administrator should run a process to post these Journal entries to the general ledger.

Figure 3 Asynchronous communication with MQSeries
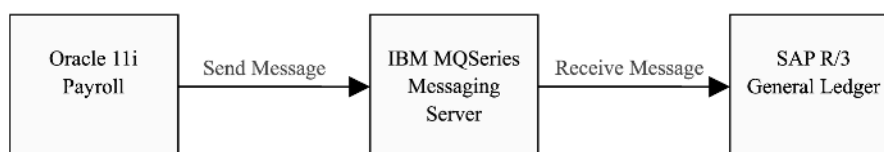
5. Summary and concluding remarks

The research represented an attempt to investigate the feasibility of mixing the components of different vendors when implementing an ERP solution for an organisation. ERP went through many development cycles since its beginning in the 1970s until it established itself as the backbone of most enterprises in the world. In spite of its countless advantages, ERP packages have many problems and the word "Enterprise" does not reflect the whole organisation; it barely represents the back office processes. Besides, the heavy customisation required by ERP packages to suit the companies' special needs, it is very expensive, time consuming and causes future upgrades to be a nightmare. Therefore, many companies are seeking a solution to avoid customisation and make ERP implementations and upgrades straight forward. This later statement has led the authors to investigate whether organisations follow a best of breed approach and integrate their ERP modules.

In order to prove that mixing and integrating the components of different ERP vendors is feasible, the case study of S-Tel was used to demonstrate and verify the concept. Using semi-structured interviews, observations and document sampling, the problem of S-Tel was analysed and defined; and was used to illustrate the ideas throughout the research. Proving this concept on a big variety of ERP components with different vendors is a very difficult task. It is much easier to consider integrating one module of an ERP to the whole suite of another ERP. S-Tel's problem was suitable for this investigation because it complied with this criterion and allowed us the opportunity to investigate the feasibility of integrating the HRMS module of Oracle applications to the SAP ERP suite.

The recommended solution to S-Tel's problem was to integrate Oracle HRMS with SAP using a integration software. Oracle HRMS provides S-Tel's HR department with all the functional requirements and a range of additional benefits as well; covering all functional gaps in the SAP standard HR module. Finally, the recommended solution was proved to be feasible to implement and cost-effective. In its attempt to piece together these systems, S-Tel used EAI solutions.

The EAI technology is increasingly used by most of the major organisations in the world. Establishing a flexible and maintainable EAI infrastructure, enables the company to easily integrate different systems. S-Tel selected its integration vendor after a long feasibility study and applying a set of criteria identified very carefully. Using S-Tel selected EAI tool, which was IBM's MQSeries, the integration link between Oracle and SAP was identified and built. The success of this process proved the overall success of the concept of mixing the components of different ERP vendors.

Overall, this investigative piece of research has achieved its objectives, and mixing the components of different ERP vendors has proved to be feasible in terms of the concept and practice. The paper also demonstrated that this concept is now feasible with the use of EAI tools. The case study, illustrated that it can be done in practice by analysing S-Tel's problem, recommending a solution and defining all the variables that might be faced during the implementation and the integration phase of the project.

This research was an attempt to correct a misunderstanding that some researchers and business consultants have about the feasibility of mixing the components of two or more ERP's. The success of this attempt should encourage enterprises not to be tied to a single vendor forcing its applications and dictating the solutions. In fact, by doing so, they will be able to gain maximum functionality and with equal or probably less cost. The increasing use of EAI nowadays, provides a rich media to give life to this idea and prove it as a new discipline for EAI.

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Note from the publisher

Management journals and more; Emerald Management Xtra launches in 2005

For 2005, Emerald Group Publishing Limited will be launching the world's largest collection of peer-reviewed business and management journals, Emerald Management Xtra. As well as more than 100 research journals, the Emerald Management Xtra collection also features independent reviews of papers published in 300 of the world's major English language business journals, plus a newly developed range of online support services for researchers, teaching faculty, academic authors and others.

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Awards for Excellence

Atta Badii
University College Northampton, Northampton, UK

and

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Brunel University, Uxbridge, UK

are the recipients of the Journal's Outstanding Paper Award for Excellence for their paper

"Information management and knowledge integration for enterprise innovation"

which appeared in ***Journal of Enterprise Information Management***, Vol. 16 No. 2, 2003

Atta Badii is Principal Research Fellow and Group Leader (Intelligent Media Systems & Services) at the Informatics Research Centre, University of Reading. He is also a Research Director of the East of England Telematics Development Trust, Cambridge Innovation Centre (EETDT, www.TelematicsEast.org.uk), Chairman and Research Director of e2e Research Limited, Founding Chair of the EnCKompass International and UKAIS (Midlands) Research Networks. He is a member of the UK Committee of Information Systems Professors and is co-opted to the Board of UKAIS. Atta has a multi-disciplinary academic and industrial research experience involving the fields of distributed intelligent systems, enterprise application integration, eBusiness, virtual enterprise architectures and knowledge management. He is a programme or editorial committee member of several ICT and Knowledge Management Journals and research conferences including, for example, the *European Journal of Knowledge Management*, the *International Journal of Business Process Re-engineering*, and, the *European Conference on Knowledge Management*.

Dr Amir Sharif is currently a Business Analyst within the Equities IT division of UBS Investment Bank, in London, principally involved designing and developing business systems for the equities business. He has also held a position as a Management/IT Consultant with KPMG Consulting, UK, where his role involved providing business advice and technical consultancy to many leading national and multinational organisations. Amir obtained his BEng (Hons) in Aeronautical Engineering from City University, London in 1994 and was awarded a PhD in Information Systems, from the Department of Information Systems and Computing at Brunel University, UK, on the subject of Knowledge Representation/Knowledge Management, in 2004. Over the years, Amir has also held numerous teaching posts both at Brunel University and as a Visiting Lecturer for the University of London, lecturing on subjects such as Software Engineering, Knowledge Systems, and Java programming. Amir has a keen interest in Information Systems Management and Evaluation, eBusiness, Organisational Learning and Artificial Intelligence. He has published research in these areas and has also been a committee member on several international and national, peer-reviewed journals and conferences.