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CUSTOMER-CENTRIC IS APPLICATION DEVELOPMENT: LESSONS FROM A CASE OF DEVELOPING AN ONLINE AUCTION SITE

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ABSTRACT

Recent years have witnessed many organizations switching from function-oriented to customer-centric in their information systems applications designs. This paradigm shift has attracted growing attention among researchers in better understanding the design process of customer-centric IS applications; an area that has not been investigated adequately so far. This paper examines the processes of gathering and segmenting customer-centric attributes during the design stage of an IS application development by analyzing data extracted from a successful case of developing an online property auction site. The findings reveal that gathering and segmenting customer-centric attributes during the design stage of a customer-centric IS application development encompass four phases: (1) Identify customer requirements; (2) Structure customer requirements; (3) Link customer requirements to system design attributes; and (4) Review the level of customer satisfaction with the new system. We discuss the implications of our findings for both research and practice.

KEYWORDS: Customer-centric IS applications, Gathering and Segmenting customer-centric attributes, Design stage, Case study.

I. INTRODUCTION

Keen competition in dynamic business environments has driven companies to rush to create a customer-centric enterprise [Galbraith, 2005]. With rapid advancement of information technology (IT), enterprises adopt customer-centric information systems (IS) applications to transform themselves into customer-centric organizations. Basically, the customer-centric approach differs from the function-oriented design in that it places customer requirements at the center of an

organization's system design effort, focusing on customers rather than its business functions[1]. To sustain competitive advantage, companies must go beyond simply applying technological tools and techniques to include a shift in values, assumptions, and premises [Soh et al., 2000], guiding the entire business activities towards understanding and fulfilling customer requirements. Traditionally, customer satisfaction has been identified as the ultimate goal of any business [Lengnick-Hall, 1996] as companies focus on providing products and services that fulfill customer requirements [Bowen et al., 1989]. To achieve this goal, companies foster direct customer contacts, gather information from clients about their requirements, and use customer-supplied information to design, and deliver products and services [Schneider and Bowen, 1995].

Recent years have witnessed many companies publicly declaring their commitment in becoming more customer-centric. The challenge for these organizations is to design and manage customer-centric IS applications which are flexible, easy to maintain, and quick to integrate with legacy systems for better customer service [Gefen and Ridings, 2002]. Despite the vital role played by customer-centric IS applications in organizations, there is little research conducted so far to examine the design process of customer-centric IS applications [Albert et al., 2004; Liang and Tanniru, 2005]. This paper examines the processes of gathering and segmenting customer-centric attributes during the design stage of an IS application development by analyzing data extracted from a successful case of developing an online property auction site[2]. The remainder of the paper is organized as follows: First, we discuss the emergence of customer-centric IS applications. Next, we describe our research approach. A description of the case follows, where we analyze the design process of a customer-centric IS application development. We conclude by highlighting the implications of our findings for both research and practice, with suggestions for future research.

II. THE EMERGENCE OF CUSTOMER-CENTRIC IS APPLICATIONS

In this competitive, ever-changing business environment, customers are demanding more value, customized to their exact requirements, at less cost, and as quickly as possible [Winer 2001]. With heightened competition and demanding customers, success in the marketplace hinges on deployment of resources to design products that meet customer requirements [Kekre et al., 1995]. The 'voice of customers' has to be heard by all, and customer responsiveness has to become the highest priority [Griffin and Hauser, 1993; Pan and Lee, 2003]. According to Lengnick-Hall [1996], customers are increasingly influential in what organizations produce and deliver, and may directly influence the operations and outcomes of an enterprise. Schneider and Bowen [1995] suggest that if organizations view their customers only as end users, they may be less competitive as compared to their counterparts who involve their customers in a variety of roles that expand and deepen the relationship. Besides, input from customers ought to be considered as a form of resource provided for use in the product or service transformation processes [DeGreene, 1973]. Identifying customers with individualized demands and customizing the services may enable a firm to smooth out its transformational activities and develop a niche. As a prerequisite for managing customers effectively, firms ought to be aware and consistently monitor their customers' varied expectations [Pan and Lee, 2003].

El Sawy et al. [1999] suggest that to survive in demanding business environments, organizations need to innovate and invent new ways of creating value, and require different enterprise architectures and IT infrastructures to meet customer demands. Clemons and Hann [1999] also suggest that as a consequence of the need to satisfy customers, understand their objectives, and

[1] In this paper, we focus on the alternative design approaches rather than the different types of system to represent the difference between the customer-centric approach and the function-oriented design.

[2] Customers refer to both individuals and organizations (i.e., represented by individuals) who transact using the online property auction site.

deliver appropriate levels of service, IT plays a major role in customer-oriented business strategy. In fact, IT-enabled customer focus firms use IT to differentiate their products and services to meet the requirements of focused markets and customers [Baty and Lee, 1995]. A customer relationship management (CRM) system may provide the solution to develop long-term customer relationships [Dyche, 2002]. CRM systems build upon sales force automation capabilities and offer advanced functions [Geib et al., 2005]. CRM systems aim to automate customer service operations so as to reduce costs of sales, boost revenue, and collect better customer data to improve support and increase selling opportunities [Karimi et al., 2001]. In general, CRM systems are categorized as operational (e.g., online marketing), analytical (e.g., a CRM data warehouse), or collaborative (e.g., web and online communities) [Trepper, 2000]. The driving force behind the growth of CRM systems in recent years has been the increasing competition due to globalization, the widespread use of electronic commerce, and the increase in customer expectation for high quality customized online service [Gefen and Ridings, 2002].

Despite lucrative incentives and significant increase in CRM investments, in reality, many companies have yet to significantly improve the level of customer satisfaction [Karimi, et al., 2001]. One reason may be due to the continued emphasis on traditional function-oriented IS application designs by some organizations and little emphasis placed on developing customer-centric IS applications [Liang and Tanniru, 2005] or rather, inadequate user viewpoint is sought to design the functionality of the system [Iivari and Iivari, 2006]. The design must be represented in such ways that it can be easily understood by all stakeholders [Gulliksen et al., 2003] and the views of customers (and potential customers) must be integrated into the development cycle [Beyer and Holtzblatt, 1998]. The argument for providing customer-centric on-demand services is that having satisfied customers would bring about stronger competitive positions which may result in higher market share and profit [Clemons and Weber, 1993]. Besides, several industry experts have also recommended that designing customer-centric IS applications be given priority as a strategic objective [El Sawy et al., 1999]. Our review of the IS literature suggests that this is indeed a significant area that has been very popular in practice but not investigated adequately in research which this study aims to address some of the issues.

III. RESEARCH APPROACH

We chose a case study approach in this study, as it is particularly appropriate for exploratory research of this type [Yin 1994]. Generally, the case study method is an appropriate means of empirical inquiry and theory-building in an area in which there has been relatively little prior research [Benbasat et al., 1987]. Our study focuses on the activities involved in the processes of gathering and segmenting customer-centric attributes during the design stage of an IS application development by analyzing data extracted from a successful case of developing an online property auction site, Property Co (a pseudonym), based in Sydney, Australia. A major reason why we selected this case is because Property Co's online auction site represents a successful example which demonstrates how Property Co gathered and integrated customer-centric attributes into the features of its online auction site.

Data were collected mainly through personal interviews and supplemented by documentations about the organization, including information from the website, company's key performance indicators, results of cost benefit analysis, and return on investment payback period. For example, the Marketing manager provided reports on customer satisfactions and feedbacks. Interviews were based on customized topic guides, which indicated relevant probes at suitable junctures. During the interviews, interviewees were encouraged to speak freely about the entire design process of the customer-centric online auction site. The interviews were retrospective and semi-structured in nature. Historical reconstruction of the events was performed by the field researcher. All interviews were tape-recorded and transcribed. Data were collected at Property Co over eight months (May 2005–January 2006). The E-Services Director provided the access. Once access was given, interviews were conducted within the organization in what may be described as the snowballing effect [Buchanan et al., 1994]. Most of the selected interviewees were directly related to the online property auction project development (see Appendix A).

Altogether, 31 face-to-face interviews were conducted with 28 interviewees, with an average duration of between one and one and half hours per interview. The interview transcripts were used to prepare a case summary which was later shown to the E-Services Director, who recommended very few amendments. Evidence gathered from interview transcripts and other secondary documents played a crucial role in establishing triangulation and in maintaining the chain of evidence [Yin, 1994]. Throughout the entire data collection process, inter-subject reliability was improved by using the narratives from one subject to confirm or contradict others in social triangulation [Miles and Huberman, 1994]. Clearly, we did not attempt to privilege one account over another. The field researcher observed that there was no overt attempt by the interviewees to systematically conceal details or distort accounts.

In the data analysis stage, rich insights that were available in the case were sought. We prepared a detailed case summary after completing the case study. The analysis focused on how Property Co identified its customer requirements and incorporated them into the system by linking the requirements to the system design features. We relied heavily on the field evidence which included both the interview transcripts and other secondary documentation. By analyzing the data, we identified several key issues and formed major phases in the design process. Direct quotes from the interviews were categorized according to these issues. In order to reduce researcher bias, one of the authors who was uninvolved in data collection and so was unfamiliar with the case, was invited to take part in the data analysis. The role of this other author was to "bring a different and possibly more objective eye to the evidence" [Eisenhardt, 1989, p.538]. The field researcher did not show him his list of issues. This other author was requested to develop his own list. The next step was to develop a conciliated list which comprised the major activities that formed the design process of the customer-centric online auction site. An example that was identified as a major activity was how solicited customer perceptions and feedbacks influenced the design of the online auction site. The entire data analysis process was highly iterative. During the data analysis stage, we triangulated various sources of evidence [Yin, 1994]. In the final step of our analysis, we compared our findings to various theories from the IS literature, and conducted a comparative analysis. The iterative process ended when "theoretical saturation" [Yin, 1994] was reached.

IV. CASE DESCRIPTION

BACKGROUND

Property Co was founded in Australia in July 1991 to manage industrial estates for tenancy and maintenance matters. The company manages approximately 4,000 industrial tenanted properties. Property Co's online auction site is an example of a successfully designed customer-centric IS application because the entire design process consisted high customer-centricity with an aim of developing customer-centric capability. The transformation from traditional bidding system to the new online auction system resulted in time and cost savings, enhanced service quality and generated major financial benefits such as reduced loss of revenue due to vacant premises. The rapid turnover of vacant units would translate to early realization of rental revenue, conservatively estimated at AUD$14 million per annum. In addition, the project had achieved positive Return on Investment (ROI) within 13 months after its initial set-up. The relevant stakeholders of the new online auction system include the Customer Support Unit (CSU), the Tenancy Management Unit (TMU), the E-Services Unit (ESU) and the Marketing Department (MD). The CSU handles customer services and general enquiries. The TMU verifies that selected property units are ready for lease and performs any approval of the units before actual bidding takes place. The ESU maintains the organization's technical architectures and infrastructure. The Marketing Department owns the online auction system and the department's daily job responsibilities include preparing tender documents, calling tenders for leasing of properties and conducting evaluation of the bidders. The development of the online auction system started in April 2004 and was officially launched in April 2005. The new online auction system represented a significant advancement in how Property Co served its customers. The main objective of designing and implementing this

customer-centric online site is to improve transparency and timeliness of tenders during the bidding process.

Before the online property auction initiative, Property Co relied on traditional bidding process which was time-consuming and inefficient. The allocation of industrial premises was offered via a three-week closed tender. Potential bidders have to visit Property Co personally and view a list of vacant industrial property units. This would follow by the purchase of an application form which consists of documents such as floor plans, location maps, and premise specifications. Since it is a closed tender system, no one knows how much or how many bids will be placed for a particular unit, and therefore have to bid the highest amount that he or she is willing to pay for a particular unit. After making the decision, the potential bidders will place the banker's check (i.e., a month's rental) and the completed application form in a tender box at the Property Co's office. This bidding mode usually involves 6 weeks from the opening tender period to the actual release of successful bidders. After that, another two to four weeks are required for the processing of Tenancy Agreements before successful bidders could gain access to their units. The entire process includes the preparation of tender documents and newspaper advertisements, coordination of witnessing the opening of tender box, approvals spanning across relevant sections and finally, the review of the applications.

The manual bidding system requires immense efforts to coordinate, share information, handle enquiry calls and involves high operating costs. For example, before the bidding period begins, a list of available units would be advertised in the local newspapers. Additional costs will be incurred to handle customers' enquiries, organizing bidding events, circulation, and publication of information related to the units. In the manual tender system, the pricing issue was extremely sensitive and customers had to seal their bids in envelops and the final bid would not be disclosed till the end of the bidding period. Often, customers would be left feeling frustrated because they were unable to obtain their preferred units due to the slightest price differences. According to the Marketing Director:

> "The closed tender system seemed to have problems. For example, many customers had expressed explicitly that they were willing to pay higher rentals to obtain their preferred units. If the tender exercise was transparent, our revenues and number of customers would definitely increase." [Marketing Director, 19 October 2005, #PC-14-15]

Several alarming sales reports in December 2003 highlighted the need to revamp the traditional closed bidding system. The occupancy rate for vacant units had significantly decreased from 82 percent in 2002 to 68 percent in 2003. Among its 4,000 industrial tenanted properties, 1232 units remained vacant in 2003. This was probably the first time in the company's history that the vacant units had surpassed and remained above 1000. Furthermore, Australian's industrial property market was performing reasonably well at that time. The rental income for industrial properties increased by 15 percent in the 2002-2003 time period. According to the Strategic Director:

> "The alarming sales figure presented itself as a wakeup call for everyone in the company. Radical changes had to be made before the situation turned worse. We had to devise an effective sales mechanism to lease the vacant units more efficiently. We aimed to create a new customer experience" [Strategic Director, 29 October 2005, #PC-18-11].

Property Co recognized that problems existed within the bidding process – too lengthy and inefficient. A more efficient and transparent bidding system was clearly desired to improve customers' overall satisfactions in the bidding process and hopefully this would attract more customers.

CUSTOMERS' REQURIEMENTS RECOGNITION AND CATEGORIZATION

Before designing the online auction site, Property Co identified several key customers' requirements that are crucial to how the new site ought to be designed. Property Co's customer service operators provided a detailed analysis of their customers' requirements based on their own experiences of handling the customers on a daily basis. These requirements are summarized below in Table 1.

Table 1: Customers' Demands during the Bidding Process as Identified by the Customer Service Operators

No.	Customers' Requirements
1	Savings on having to travel to Property Co's premise, purchase tender documents and submit forms.
2	More frequent bidding cycles.
3	Online access to vacant premises information (24-hours-a-day, 7-days-a-week).
4	Increased transparency so as to allow 'out-bid' bidders to scan for other premises.
5	Lower deposit amount for placing bids.
6	Allow monitoring of any bid changes with mobile bidding.
7	Early release of bidding results. Results released instantaneously upon closing of bidding cycle.
8	Fast turnaround time for each bidding cycle.
9	Provision of information content: details of vacant units, the location map, technical details, the starting current and historical bid amounts, and the level and unit floor plans.

Besides gathering the customer service operators' opinions, Property Co conducted a survey of its customers who had either participated in its property bidding process or would be interested in participating in its bidding process. Approximately 457 users were selected randomly, including 129 unsuccessful bidders, 111 successful bidders and 217 users who had never bid. The survey focused on the objective of the new online auction site, its main offerings, the value creation, customer satisfaction measurement, and the process of customer relationship management.

Property Co structured the list of customer requirements into separate levels. For example, in the basic level, the consideration of an online site would emphasize the clarity and resolution, ease of use, and viewing inter-activeness. In the second level, each customer need was dissected into several more defined requirements. For example, the second-level requirements for clarity and resolution would be providing information on how customers consider clarity by distinguishing detail on the screen and being able to read graphically generated text. For third level requirements, a customer may judge the crispness of graphically generated text by the ability to differentiate lines from background images and text, and the ability to make a distinction among individual lines.

LINKING CUSTOMER REQUIREMENTS TO DESIGN ATTRIBUTES

The new online auction site comprised three key components: (1) client software in PCs used by marketing officers within Property Co; (2) servers supporting high-end PCs located at Property Co; and (3) a web-based application designed for customers. The new system would enable customers and marketing coordinators at Property Co to connect to the internet and complete all activities needed to define the property requirements, register availability, award a contract, schedule and track a valid bid, and reconcile payment. Transactional data were stored in a

Microsoft SQL database and were used to produce monthly management reports. Three major categories of customers' requirements, their descriptions and associated attributes were identified and are summarized in Table 2 below. Table 3 provides the customer requirements identified and their corresponding requirements in second and third levels.

Table 2: Categories of Customer Requirements, their Descriptions and Associated Attributes

Category	Description	Attribute
Performance Satisfaction	Measures the variance between customers' expectations and experiences in the bidding process	Ease of use, Clarity, and Availability
Preservation of Customers' Trust	Gains and preserves the customers' trust	Privacy and Security
Service Transformation	Improves the level of customer service	Service quality

The development team identified the customer requirements and linked these customers' perceptions to system design attributes. For example, customers requested high level of clarity when reading graphically generated text. One answer to this need is the ability to differentiate lines from background images and text. The corresponding design attributes for the system could be the illumination of alphanumeric characters. The size of the alphanumeric characters was only one of the design attributes that affected the customer need of "easy to read text." The readability of a text string also would depend on the colors that the software designer chose, the ratio of the height of the letters, and even the style of the typeface. All of these design attributes interacted with one another to affect the customer need of "easy to read text." Some might be less costly and more effective, some might be synergistic, but all were evaluated before the final design was selected. During the design process, the relationship matrix displayed judgments on which design attributes would affect which customer requirements, and by how much. The analysis also revealed the relationships between the technical requirements of the system and whether they had impeded or facilitated one another. For example, increasing the illumination of the screen might decrease the speed of the screen refreshes. Finally, the analysis also summarized the costs and technical difficulties of changing a design attribute.

THE LAUNCH OF THE NEW ONLINE AUCTION SITE

The online auction site was launched in April 2005. Since Property Co's core competency was to provide industrial facilities that would continue to meet the changing requirements of customers, the online auction site was envisioned to serve as a portal through which industrial premise leases are allocated fairly and effectively to customers. The online auction site would provide the details of vacant units that are available for lease. These include the location map, technical details, the starting current and historical bid amounts, and the level and unit floor plans. The deposit was reduced from the bid amount to a fixed amount of AUD $500. The system development cost was AUD $500,000 (approximately US $360,000). Ongoing system enhancements, maintenance, and web hosting costs were approximately AUD $150 000 (approximately US $108,000) per annum. Some of the costs also included hardware leasing which were incurred to manage increasing transactions, credit card payment gateway customization for multiple concurrent bidding cycles, and costs to customize system during organization restructure. Table 4 summarizes the steps involved in the new online bidding process.

Table 3: A Three-tier Analysis of Customers' Requirements

Level One Need	Corresponding Level Two Need	Corresponding Level Three Need
Ease of use	• Ability to complete the bidding process with little or no customer service support	• Access to adequate step-by-step how-to-use instructions
Clarity	• Ability to read graphically generated text	• Ability to differentiate lines from background images and text • Ability to make a distinction among individual lines
Availability	• Ability to access to premise information (24-hours-a-day, 7-days-a-week)	• Ability to access up-to-date information with basic internet access from anywhere and anytime
Privacy	• Ability to remain anonymous	• Allow the use of nicknames and display these nicknames only on screen
Security	• Ability to transact in an secure environment	• Access to Pay-pal secure transaction network
Service quality	• Ability to access to immediate technical and customer service support	• Provide customer 'Frequently Asked Questions' and other technical and customer service facilities

Table 4: The New Online Bidding Process

The New Online Bidding Process
Step One: Generate Bid • A new bid is entered into the Property Co online auction system. • Is the bid for an industrial property unit? **If yes, go to step two**. • If no, customer is notified for instructions.
Step Two: What is it? When is it needed? Property Co analyzes the bid entry by assessing customer's internal bidding systems. • When the lease would begin? • What type of property unit?
Step Three: Amalgamation Opportunities • The system searches for amalgamation opportunities.
Step Four: Unit Optimization • Property Co optimizes the bid by determining the most suitable unit.
Step Five: Who Will Win It? • After the specific bidding period, Property Co awards the selected unit to the highest-bidder.
Step Six: Payment • Property Co audits the lease contract and forwards it to the necessary payment center(s).

As one ESU system analyst pointed out:

> "Luckily, customers did not constantly change their requirements. ESU contributed their technical opinions and suggested improvements to the requirements. There were certain things that could be done in an online system but not in a manual one and vice-versa. Requirements were confirmed after a few rounds of clarifications and compromises." [ESU system analyst, 28 July 2005, #PC-12-11]

CUSTOMER SATISFACTION REVIEW

The new online auction site was successfully implemented and brought about tremendous improvement in the entire bidding process. Table 5 presents the major differences between the original bidding system and the new online auction system.

Table 5: A Comparison between the Old and New Bidding Systems

Process	Traditional Bidding System	Day(s)	Online Auction Bidding System	Day(s)
Determines available units for lease.	Checking of mainframe for expired leases.	1	Same.	1
Marketing Department Heads from four separate zones verify that selected units are ready for lease.	Verifications and approvals within the Industrial Projects team.	5.5	Electronic submissions.	3
Marketing Department to prepare tender documents and call tender.	Preparation of documents for available details.	5.5	Online viewing of details, bidding schedule monthly.	1
Tender Board approval.	Approvals by the Tender Board.	3	Electronic approval.	2
Tender System	Closed Tender. Only the winning bid and the company name will be listed in the result, three weeks per tender, and one-month deposit in bankers' check.	16.5	Open bidding. Current bid prices are available for all bidders. The top three highest bids will be listed in the result. One week per tender, $500 deposit via credit card.	5.5
Evaluation of bidders' company and trade suitability by Marketing Department.	Documentation processing.	5.5	Electronic approval.	3
Tender Board	Documentation processing.	3	Electronic approval.	2
Publication of results	Results available at Property Co	5.5	Results available online.	1
Total Man-days		44.5		16.5

The occupancy rate for units that were previously left vacant for long periods was improved by the Quick Bid method of allocation where bidders were able to secure a unit in ten minutes, if the desired unit has no other contesting bidder. The number of hits to the site increased tremendously from 200, 000 page views in May 2005 to 600,000 in November 2005. In terms of

whether the organization had achieved the goal of satisfying its customers, the results were very positive and are presented in Table 6 below.

Table 6: 'Customer Satisfaction with the New System' Survey Result

'Customer Satisfaction with the New System' Survey Result
• Shortened delivery times – automation of the filing and verification processes had allowed the elimination of routine tasks, thus significantly shortening the time spent on each application form.
• Reduced crowdedness of customer service counters – the number of people who bids in person will decrease. The online auction system resulted in the two counter staff reassigned to other job scopes.
• Faster and higher potential revenue realization through quicker allocations through Quick Bids.
• The online auction system's capability to accommodate 'sub-portals' for other agencies to allocate properties online also created opportunities for potential revenues.
• Easy with 24x7 access
• Potential customers no longer have to purchase the tender documents at the Property Co counters with the availability of all the information about the units, including photos and up-to-date bid information available online.
• Even non internet savvy users have little difficulty of using the online auction site. Cheaper bidding cost (AUD$50) is also another factor that attracts customers.
• 95% of customers found the online auction site transparent and secured.

According to the CSU Manager:

> "Over the years, we learned that nobody owns the customers, but the customers own us. To be successful in today's business environment, customers require the company to do business the way the customer wants." [CSU Manager, 4 October 2005, #PC-23-14]

The ESU Manager also highlighted the importance of 'customer-centricity':

> "The senior management is fully aware of the importance of having a customer-centric mindset. However, this may be insufficient. More importantly, one should not underestimate the changes needed to implement customer-centric systems and having the assumption that they are already customer-centric." [ESU Manager, 15 June 2005, #PC-21-15]

The ESU Director concluded:

> "The company could not simply insert an IS application into the organization and expect to capitalize on customer relationships. To build a customer-centric system, we need to understand the customers and design our system around them." [ESU Director, 27 May 2005, #PC-04-06]

V. DISCUSSION: REVISITING THE FINDINGS IN LIGHT OF THE PROCESS OF GATHERING AND SEGMENTING CUSTOMER-CENTRIC ATTRIBUTES DURING THE IS APPLICATION DESIGN STAGE

IDENTIFY CUSTOMER REQUIREMENTS

Ulrich [1989] encourages firms to identify their customer requirements so as to build an interdependent relationship with customers and foster customer commitment and loyalty.

Customer feedback may prompt the introduction of new products and/or services that customers' desire, causing the firm to broaden its overall product and/or service availability and improve its service reliability. In the case of Property Co, the organization recognized the importance of understanding what customers want and incorporating these customer requirements into the design of the new system. The organization collected the information from employees who had handled the customers on a daily basis and conducted a survey of its customers who had participated in the property bidding process. The survey focused on several areas which included the objective of the new system, its main offerings, the value creation, customer satisfaction measurement, and the process of customer relationship management. After information was collected from its customer service operators and customers, the organization analyzed the results carefully before identifying the actual requirements of its customers.

Basically, Property Co used perceptions of customer requirements as a lens to understand how system characteristics and design might affect customer preference, satisfaction, and ultimately, their level of participation [Krishnan et al., 1999; Knittle et al., 1986]. For example, when describing images on the screen, customers might demand "a high level of clarity which the lines should not contain any stair-step effect." Therefore, this might represent a clear description of how customers want images to appear on the computer monitor. Identifying customer requirements is critical for any system design, since well established research in the technology management area suggests that cooperation and communication among marketing and system development teams lead to greater system design success [Pinto and Pinto, 1990; Kekre et al., 1995]. Furthermore, if responsiveness, customization, differentiation, and flexibility are key elements of a firm's strategy, then understanding what the customers require and then incorporating these customer requirements into the design of the product (i.e., the new system) may prove valuable for a firm [Bowen et al., 1989; Knittle et al., 1986].

STRUCTURE CUSTOMER REQUIREMENTS

Customer requirements can be categorized into a hierarchy of strategic, tactical, and operational requirements [Griffin and Hauser, 1993]. Strategic requirements are major user requirements adopted by the project team to set the strategic direction for the system. In the case of Property Co, for example, the strategic requirements helped the project development team decide to develop an online site that emphasizes clarity and resolution, ease of use and viewing interactiveness. Each strategic need was elaborated into several tactical requirements. Tactical requirements provide more specifically what the development team must do to satisfy the corresponding strategic need. For example, if clarity was the strategic need, the corresponding tactical requirements would be to provide information on how customers would consider clarity by the ability to distinguish detail on the screen and by the ability to read graphically generated text. These tactical requirements helped the development team pay more attention to those more-detailed benefits that fulfilled the planned direction implied by the strategic need. The operational requirements provide detail so that software engineers and programmers can develop solutions that satisfy the tactical requirements. For example, a customer might judge the crispness of graphically generated text (a tactical need) by the operational requirements of the ability to differentiate lines from background images and text, and the ability to make a distinction among individual lines. Knowledge of which system features fulfill which requirements best, how well those requirements are fulfilled, and whether there are any gaps between the system and customer expectation may provide further input into the design decisions made by the development team.

LINK CUSTOMER REQUIREMENTS TO DESIGN ATTRIBUTES

The design features of a system may affect the ease with which customers accomplish their objectives. For example, system layout may decrease customer search time, improve processing efficiency, and facilitate customer orientation within the system. Thus, physical design elements may "simplify the customer's role in the service encounter" [Chase and Hayes 1991], thereby making the system more "user friendly." In the case of Property Co, the development team

identified relevant customer requirements and linked these customers' perceptions to system design attributes. Performance satisfaction was linked to the design attributes of ease of use, clarity and availability. For example, customers demanded a high level of clarity when reading graphically generated text and the corresponding design attribute would be the adoption of luminous alphanumeric characters.

By paying attention to customer requirements and incorporating these demands into the system design, customers may be more inclined to patronize the "customer friendly" facility again [Chase and Hayes, 1991]. Furthermore, Property Co adopted the relationship matrix indicating which design attributes would affect which customer requirements and by how much. The analysis also revealed the relationships between the technical requirements of the system and whether they had impeded or facilitated one another. Such analysis is useful since the organization could assess the costs and technical difficulties of changing a design attribute and specify target values for each of the design attributes. The development team could multiply importance times the gaps in customer perceptions to obtain "improvement indices." Finally, it is important to note that the system features may also impact work productivity. For example, the design attribute would consider enabling the system to serve a larger volume of customers in a given time frame, with greater reliability and consistency.

REVIEW THE LEVEL OF CUSTOMER SATISFACTION WITH THE NEW SYSTEM

Two views have been presented on customer satisfaction [Yi, 1990]: (a) customer satisfaction as an outcome and (b) customer satisfaction as an experiential process by reducing the expectation-experience gap through reliable feedbacks. In the case of Property Co, the system was successfully implemented and the online auction site brought about tremendous improvement in the entire bidding process. For example, in the old bidding system, it took the Marketing Department 5.5 days to prepare the documentations of the available units every month. With the new online auction site, customers could view the details and monthly bidding schedule online. More importantly, the entire process within the previous closed bidding system would require 16.5 days and the new online bidding system would only need 5.5 days. Furthermore, the occupancy rate for units previously left vacant for long periods was improved by the Quick Bid method of allocation where bidders were able to secure a unit in ten minutes, if the desired unit had no other contesting bidder.

Table 7: A List of Characteristics of the Gathering and Segmenting Phases during System Design

Phase	Characteristic
Identify Customer Requirements	• Recognized the importance of understanding what customers want • Collect the information of customers' requirements • Incorporate customer requirements into the design of the new system
Structure Customer Requirements	• Categorize customer requirements into a hierarchy of strategic, tactical, and operational levels
Link Customer Requirements to System Design Attributes	• Pay attention to customer requirements and incorporate these demands into the system design • Use relationship matrix to study how design attributes would affect customer requirements and by how much
Review the Level of Customer Satisfaction with the New System	• Assess customer satisfaction both as an outcome and as an experiential process through reliable feedbacks

Generally, customers were satisfied with the new system. This was witnessed by the rising number of hits to the website which increased from 200,000 page views in May 2005 to 600,000

in November 2005. Overall, the company achieved considerable savings on processing tender documents and allocation processes, as well as more frequent bidding cycles and faster turnaround time for allocating premises online. The ultimate aim of integrating IT with marketing strategies was to provide an improved customer experience while simultaneously reducing the cost of service delivery. The use of a customer-centric IS application had helped Property Co to transform the way a property company performs the menial role of providing affordable business premises to its customers. Overall, having customer-centricity as the main objective had allowed the company to realign its structure and processes [Gefen, 2004]. Table 7 provides a summary of characteristics of the gathering and segmenting phases during system design.

VI. IMPLICATIONS AND CONCLUSIONS

The rapid proliferation of the Internet has led to organizations adopting customer-centric rather than function-oriented IS application designs. In this paper, we have described and analyzed the processes of gathering and segmenting customer-centric attributes during the design stage of an IS application development. We used a case study of the development of an online property auction site as its basis. Data were collected primarily through personal interviews and supplemented by documentations about the organization. During the interviews, interviewees were encouraged to speak freely about the entire design process of the customer-centric online auction site. Overall, our findings reveal that gathering and segmenting customer-centric attributes during the design stage of customer-centric IS application development may involve four phases: (1) Identify customer requirements; (2) Structure customer requirements; (3) Link customer requirements to design attributes and (4) Review the level of customer satisfaction with the new system.

While many studies have been conducted to examine the development and implementation of IS applications in recent years, most of them have followed a variance theory approach towards understanding the domain. The result has been that a number of factors are now believed to be causally related to IS application implementation success. Even though some studies focusing on the IS implementation process emerged later, little is known about the level of 'customer-centricity' within IS application designs that may directly influence the level of satisfaction when customers adopt these systems. Since customer satisfaction has been identified as the ultimate goal of any business as firms focus on providing products and services that fulfill customer requirements [Liang and Tanniru, 2005]. Therefore, understanding the processes of gathering and integrating customer-centric attributes into IS design features could be relevant and important for firms to address their customers' requirements [Albert et al., 2004]. This study complements the existing IS literature by demonstrating how customer-centric attributes were considered and integrated within system designs during IS applications development. As corroboration for our findings, we note that prior literature on customer satisfaction and IS application implementation are largely consistent with what we observed in the case of Property Co. Our contribution is in the description and analysis of the design process that can serve as the basis for further investigation. With little research focusing on how customers' requirements could be integrated into the system design [Albert et al., 2004] and the importance of paying attention to the "voice of the customer" [El Sawy et al., 1999], this study complements the growing design science literature [Hevner et al., 2004] by providing insights into the processes of gathering and segmenting customer-centric attributes during the design stage of an IS applications development.

We believe that our findings may generalize to other cases of designing customer-centric IS applications. Further studies are clearly needed, however, in order to test the applicability of our findings in other contexts and, if possible, to extend these findings. More longitudinal field studies are clearly called for so that the IS research community may have a deeper understanding of the integrative lens provided by the marketing and IS streams. With better understanding, firms may employ the necessary vocabulary to design and maximize their customer-centric IS applications as an integral component of their competitive vehicle. Another potentially exciting avenue for research is to conduct multiple-case comparisons between cases with system design "successes"

and "failures". Any system design process would involve recurring decision errors, and there is a lot to be learned from evaluating 'wrong' decisions and examples of 'irrational' decisions. In this paper, we have provided some customer requirements and how they have been translated into design attributes. As our knowledge of designing customer-centric IS applications grows, we may be able to provide a greater number of customer requirements and related design attributes, as well as classifying which of the design features constitutes the greatest level of customer satisfaction. Finally, in this paper, we have used only retrospective data. There is a lack of real-time longitudinal data that directly examines the other considerations made during the customer-centric IS application design process. Future research could perhaps attempt to address this gap so as to unravel new issues surrounding the complexity of system design faced by the system developers.

From a managerial point of view, this paper provides a clear description of how major customer-centric attributes can be gathered during IS applications design and development. Customers should be allowed to participate actively and directly in system analysis and design decisions, and instructed on design choices and consequences so as to re-adjust their expectations when using organizations' IS applications. The magnitude of change in a customer as a result of using the IS applications can be measured and assessed as the completion of the system design process. As there are multiple and diversified customer requirements, this paper suggests avenues for involving various customers in system design activities and offer guidance for reconciling the competing interests. Such reconciliation must be carefully managed since customers may influence the system in either positive or negative ways. If customers develop influential relationships and become contributors to the design process, they will be more likely to act on the outcomes and be satisfied with the results. Therefore, if customer demands are incorporated in system design, it is expected that rework and failures will be reduced and valuable dimensions of quality will be highlighted. After all, the buy-in effect and self-justification behavior may positively influence the level of customer satisfaction. Furthermore, the appropriate level of customer involvement especially issues such as the customer's expertise and motivation should be carefully considered during the benefit and cost evaluations. By integrating customer capabilities into organizations' IS applications, the role of customers is reoriented and the work of employees and managers are transformed.

Finally, we have presented insights to the phases of gathering and segmentation of customer attributes, how they can be developed into customer-centric system features, and how they play a critical role in driving business objectives. The key to our approach is to structure the customer requirements into a hierarchy of strategic, tactical and operational levels and linking these requirements to design features using relationship matrix analytical tool. This approach may help managers to differentiate multiple customer requirements and align these requirements to meet organizations' business objectives, which can be useful during operational decision-making. Furthermore, by translating the customer-centric attributes into specific user requirements during system analysis and design, development teams may have a clear idea of what users require and their corresponding system design features. This may be critical for organizations since the stage of gathering user requirements during system design has been viewed as the most important phase that determines IS project development success [Ewusi-Mensah and Przasnyski, 1991; Pan et al., 2004].

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APPENDIX I: STAKEHOLDERS IN THE ONLINE AUCTION PROJECT

No	Roles	Interviewed In	Transcript
1	ESU Director	15 May 2005 (1h) – Negotiated Access 27 May 2005 (1.5h)	#PC-01-02 #PC-04-06
2	ESU Manager	15 June 2005 (1.5h)	#PC-21-15
3	Marketing Manager	20 June 2005 (1.5h)	#PC-15-12
4	CSU Manager	28 June 2005 (1.5h) 4 October 2005 (1.5h)	#PC-02-11 #PC-23-14
5	TMU Manager	15 July 2005 (1.5h)	#PC-03-08
6	ESU Assistant Manager	21 July 2005 (1.5h)	#PC-05-08
7	Project Coordination Manager	22 July 2005 (1.5h)	#PC-06-13
8	ESU System Analyst	28 July 2005 (1.5h)	#PC-12-11
9	Marketing Officer A	8 August 2005 (1.5h)	#PC-07-15
10	Assistant Marketing Manager	12 August 2005 (1.5h)	#PC-08-15
11	Marketing Officer B	13 August 2005 (1.5h)	#PC-10-12
12	Marketing Officer C	13 September 2005 (1.5h)	#PC-24-12
13	Assistant CSU Manager	18 September 2005 (1.5h)	#PC-11-13
14	Customer Support Officer A	29 September 2005 (1.5h)	#PC-19-07
15	Assistance TMU Manager	08 October 2005 (1h)	#PC-16-12
16	TMU Officer	16 October 2005 (1.5h)	#PC-13-09
17	Marketing Director	19 October 2005 (1.5h) 28 November 2005 (1.5h)	#PC-14-15 #PC-23-14
18	Strategic Director	29 October 2005 (1.5h)	#PC-18-11
19	Tele-marketing Officer	2 November 2005 (1h)	#PC-17-11
20	Front-desk Administrator A	8 November 2005 (1h)	#PC-22-06
21	Front-desk Administrator B	11 November 2005 (1h)	#PC-20-07
22	Front-desk Administrator C	16 November 2005 (1h)	#PC-21-09
23	ESU Programmer	17 December 2005 (1.5h)	#PC-25-11
24	Industrial Research Officer	2 January 2006 (1.5h)	#PC-26-18
25	Industrial Research Manager	9 January 2006 (1.5h)	#PC-28-12
26	Project Coordination Officer A	18 January 2006 (1.5h)	#PC-27-09
27	Project Coordination Officer B	20 January 2006 (1.5h)	#PC-29-09
28	Customer Support Officer B	30 January 2006 (1.5h)	#PC-30-09

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