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# Building a Value Model of CRM system through Value-focus Thinking and QFD

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## Abstract

Customer Relationship Management (CRM) is increasingly important since the emerging of electronic commerce in the past years. However, most of the current researches that deal with the decision-making problems of CRM system investments are from the perspective of the information technology adoption and organizational innovation. It is still very difficult for enterprises to measure the value of CRM systems and the subsequent decision-making on adoption priority of various CRM functions. Based on the Value-focused thinking and Quality Function Deployment (QFD) process, this paper developed a multi-layered transformation matrix, and proposed a measurement process that can be driven to a quantified value model. In order to verify the effectiveness and feasibility of the model, twelve CRM experts were interviewed including senior managers in leading management consulting companies, CRM system providers, and market researchers. Following the on-site interview, a questionnaire survey was conducted with 1000 firms in the list of the Common Wealth top 2000 firms of Taiwan. The analysis result based on 188 valid replies indicates that the outcome of the proposed value measure model has significant correlation with the investment intensity of CRM systems.

## 1. Introduction

The widespread internet technologies and e-commerce applications create a great opportunity for business organizations to communicate with their individual customers at a much lower cost than the past. Companies recognize that Customer Relationship Management (CRM) is essential to business today. According to the CIO research reports of CIO.com in 2002 [6], approximately half of the 224 survey respondents have already implemented or are in the process of implementing CRM. "CRM is the future," said one CIO surveyed. "It is necessary to stay competitive."

The CRM technology market is rapidly evolving, and new technology advancements in e-mail response, data management, business intelligence, personalization, and profiling are happening all the time. The Internet challenges firms to create compelling customer experiences and tap new efficiencies. More and more

companies try to use customer service as a competitive weapon and put heavy investment in CRM systems. Unfortunately, Nucleus Research [21] has found that one in eight CRM deployments fails to achieve a positive ROI, and the biggest barriers to a positive ROI are launching a project without attainable business objectives and investing too much time or money in a solution.

Just like most of the IT investment, most of the current researches focus on technical-economic view of CRM adoption in reducing transaction costs, streamlining process efficiency, and getting competition advantages. Unfortunately, many CRM applications are priced based on vendors' internal revenue targets – and not on the value the solution provides. [21]

How companies evaluate their CRM needs and the value of CRM systems? "Conventional approaches to decision-making focus on alternatives." Keeney [11] argued in his book: "Values are more fundamental to a decision problem than are alternatives. Alternatives are the means to achieve the more fundamental values." Keeney illustrates the concepts and procedures of "Value-focused thinking" and various selected applications that including the choice of NASA space missions, transporting nuclear waste, research on climate change, air pollution in Los Angeles and design of integrated circuit testers. This methodology is also applied to the complex strategy decisions of British Columbia Hydro, Power Authority [12] and the internet commerce [13].

Keeney measured the value of e-commerce to the customer through "Customer Values." He interviewed over one-hundred individuals about all the pros and cons of using e-commerce that they experienced or envisioned. The results were organized into 25 categories of objectives. These categories were separated into 16 means objectives and 9 fundamental objectives used to describe the bottom line consequences of concern to customers [13].

The present study extends Keeney's methodology and creates the value model for CRM system that including two dimensions—customer values and business values. Through value-focus thinking and QFD, This paper also develops an actionable process to measure the CRM systems value.

## 2. Develop the value Model of CRM system

Customer value analysis is the start point of marketing research [10]. Businesses frequently use the concept of a value proposition to characterize the combination of end-result benefits and price to a prospective customer from purchasing a particular product or service [13]. It is also important to one to one marketing and business management [1][16].

Keeney’s approach shows the way to measure the customer value of a product or service. For CRM systems, we need to consider not only just the end customers but also the organizations adopt the CRM systems. The business firms or organizations are the final decision maker of CRM system investment, not end customers.

“Who will benefit from CRM system?” Almost all of the people interviewed by the authors would agree that both the customers and the businesses that invested CRM system should be benefited. The values of CRM system to business is named as “business values” of CRM system in this paper. For the business value, we define it as the value proposition to characterize the combination of end-result benefits and price to a prospective business organization from purchasing a particular CRM system.

A common value model is the additive value function. We define the customer value of CRM is the sum of the value to end customers and the value to businesses.

$$V_{CRM} = V_{Customer} + V_{Business} \quad (1)$$

The equation (1) is very simple and straight forward. But the question is how to measure customer values and business value of CRM systems. Since the CRM system functions should meet customer needs, and create benefits to business through CRM processes and system functions for lower operation cost, streamlining process efficiency and increased sales or profits. Quality Function Deployment—QFD will be the idea methodology to convert the fundamental customer values to the necessary CRM processes and CRM system functions, and finally the benefits to businesses.

Since 1966, Quality Function Deployment (QFD) has been used world wide in every industry and sector to: prioritize spoken and unspoken customer needs; translate these needs into technical characteristics and specifications; build and deliver a quality product or service. Hauser and Clausing illustrates the QFD process is a chain of “What” and “How” conversions and translations. It will end up to a completed “House of Quality” [9]. In order to build the “House of Quality” and get the fundamental business values of CRM system, we need to link the customer needs to CRM processes and then convert the processes to required CRM functions. Figure 1 illustrates the process of these conversions. There are three steps (or three levels in the “house of quality”):

1. Link the customer needs (the customer values or fundamental objectives) to the means that businesses used to satisfy customers (the means objectives).
2. Convert the means objectives to related CRM processes.

3. Convert the CRM processes to related functions of CRM system.

Before we start to implement these steps, we need to understand the various deployment factors in above QFD process.

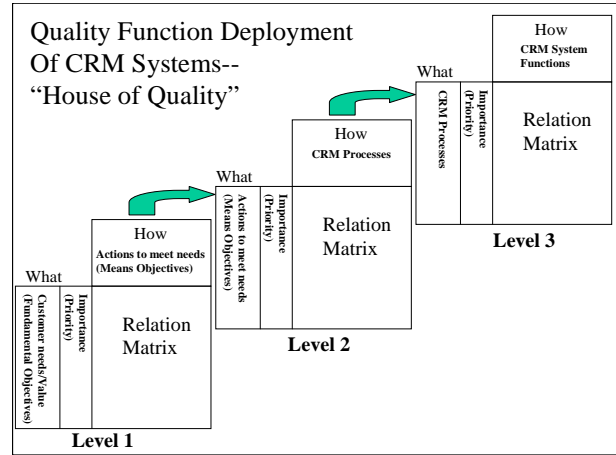


Figure 1 QFD process for CRM system

### 2.1 Customer values

“The best way to find out the customers value is to ask them.” Keeney uses concepts of value-focus thinking in three steps [13]:

1. Develop a list of customer values,
2. Express each value in a common form,
3. Organize the values to indicate their relationships.

The results are a set of means objectives and a set of fundamental objectives. The fundamental objectives also provide the foundation for developing a quantitative model of customer values.

Base on the research result of Keeney, the authors collect other 8 papers regarding the customer values of product or service, and summarize the customer values into 8 fundamental value categories (fundamental objectives) in Table 1 [4][5][7][8][10][13][14][18].

Table 1 Fundamental customer values

Reference	13	7	8	14	18	5	10	4
Customer values								
Offer multiple services		√			√		√	√
Assure reliable service		√	√			√		
Minimize cost	√		√		√			√
Minimize time spend	√	√	√	√	√	√	√	√
Maximize service hours		√			√			√
Maximize convenience	√	√					√	
Maximize safety	√	√		√				
Maximize personal service			√			√		√

According to the approach of Keeney’s value-focus thinking, these 8 fundamental objectives is defined as the customer value of CRM system and will be used in the first level of QFD (see appendix 1). The 16 means objectives developed by Keeney are reviewed and are used for presenting the action of businesses to meet

customer needs.

## 2.2 CRM processes

Peppers et al. [16] explain the four steps in the implementation of one to one marketing, which including Identify, Differentiate, Interact and Customize. The first two steps are the process of internal analysis of businesses. The other two processes are the implementation processes. For step one, enterprises need to define the target customers and record the custom, preference and shopping behavior. Step two is using 20/80 rule to find out the most profitable group of customers. It is very important to treat them differently so that the company can keep the customers and make more profits. Step three is to establish the interactive and automatic communication channel with customers. Enterprises can deliver timely information to customers and communicate with customer efficiently. Finally, enterprises should customize their products, services or even company procedures according to the differentiation of customers.

Srivastava et al. [19] define three core business processes in marketing: Product Development Management, Supply Chain Management and Customer Relationship Management. They further explain the detail processes of CRM including the eleven tasks. The other five articles regarding the CRM processes are reviewed [2][3][16][17][19][20]. The summarized result is shown in Table 2.

Table 2 CRM Processes

Reference	19	17	16	3	2	20
CRM Processes						
Identifying potential new customers	√	√	√	√	√	√
Determining the needs of existing and potential new customers	√	√	√	√	√	√
Learning about product usage and application	√			√	√	
Developing/executing advertising programs	√				√	√
Developing/executing promotion programs	√				√	√
Developing/executing service programs	√				√	√
Developing/executing sale programs	√				√	√
Acquiring/leveraging information technology/system for customer contact	√	√	√	√	√	√
Managing customer site visit teams	√				√	
Enhancing trust and customer loyalty	√	√	√	√	√	√
Cross-sell and up-sell of product service offerings	√					√

In the step 2 of QFD process, the means objectives are converted and linked to the CRM processes (see

appendix 2).

## 2.3 CRM functions

There are many CRM system providers in the market. The functions of those CRM applications are different. Since there is no unique definition of CRM system, it is very difficult to get a complete list of CRM functions. According to the research report published by Marketing Intelligence Center (MIC, the leading market research institution at Taiwan for high-tech industries), CRM system can be classified to customer interaction system and customer relationship planning system. Customer interaction system can help enterprises to collect customer intelligences through different contact channels (face to face, telephone, web and call center). The customer relationship planning can analysis customer data (data mining) and optimize the customer relationship to increase sales/profit and enhance campaign management. Data mining, Online Analytical Processing (OLAP), interactive web page, Computer Telephony Integration(CTI), Automatic Speech Recognition(ASR), Interactive Voice Response (IVR), Automatic Call Distributor(ACD), Private Automatic Branch Exchange (PABX/PBX), Voice Over IP (VOIP) are various technologies and functions in CRM applications (see Figure 2 and Figure 3).

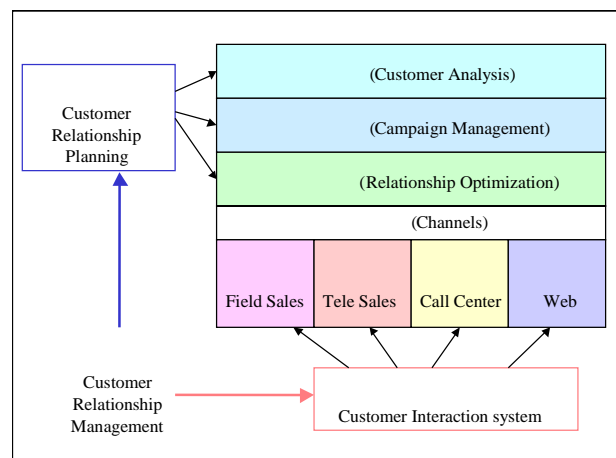


Figure 2 QFD process for CRM system

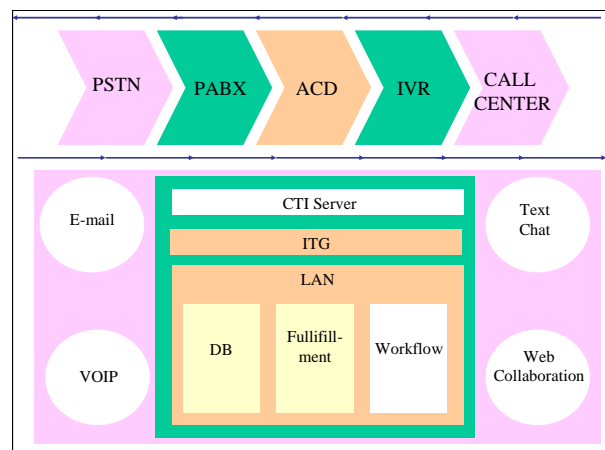


Figure 3 Technologies and functions in call center

Some of the CRM system providers divided their system functions into three areas: sales force automation, marketing automation, Customer-service automation. This definition encourage more software companies convert their conventional business software to the CRM applications. The increased CRM market competition makes the survey of CRM functions more difficult.

With the help from 3 CRM market researchers, this paper survey the product features of 11 CRM system providers including Oracle, eGain, ServiceSoft, ServiceWare, Primus, Quintus, AskJeeves, Kana, BrightWare, PeopleSoft and AKuP. 21 CRM system function categories are summarized in Table 3. In the step 3 of QFD process, the CRM processes will be converted and linked to the CRM functions (see appendix 3).

Table 3 CRM Functions

Web based Service	Help Desk for Service Agents	Sales/Marketing Support
Member Registration/ Identification	Sales Order Management	Market Research Support
VOIP	Customer Profile Management	Support New Product Development
On-line Chat	Data Analysis (Data Mining)	Promotion/Campaign management
Email reply management	Workflow for service agents support	Support Tel-sales Management
Email Auto Reply system	General database information search	Support Direct Sales Management
Web self-service	Customer service Knowledge database	
On-line help (search engine)	Service Agents Performance management	
Sales Automation (Web sales)	MRO service, scheduling and control	

### 3. Building the value model

The three QFD steps are conducted by authors through the interviews with 12 people with different CRM expertise (see Table 4). The purposes of the interview are:

1. Review the whole process to make sure it is effective and feasible.
2. Verify the completion of the list in customer values, means objectives, CRM processes and CRM functions.
3. Implement the QFD process with the help from independent CRM experts to build a generic value model for empirical study.
4. Follow up Keeney's value focus thinking methodology to covert the 21 CRM functions to fundamental objectives of business value.

The value model and processes are fine tuned according to the comments from those CRM experts. All the forms used in QFD and value-focus thinking are

reviewed and verified. No major defects are found.

Table 4 interviewed CRM experts

Classification	Area of expertise	No of people
Senior managers in leading consulting firms	CRM consulting	2
Senior managers in Market Research org.	market and technology trend research of CRM	2
Senior business managers in finance and telecommunication	CRM system users	4
Senior managers of technology provider	CRM technology provider	2
Senior managers of application provider	CRM application provider and integrator	2

Figure 4 explain the process to evaluate the CRM system through the value model. Enterprises can use the forms in Appendices to measure the CRM customer values and convert the customer needs to CRM business values through Value-Focus Thinking (VFT) and QFD methodology. Different companies might have different relationship matrix and weighting in three levels of QFD. This will enable the firms to build their own value model for their own and meet the needs of different industries.

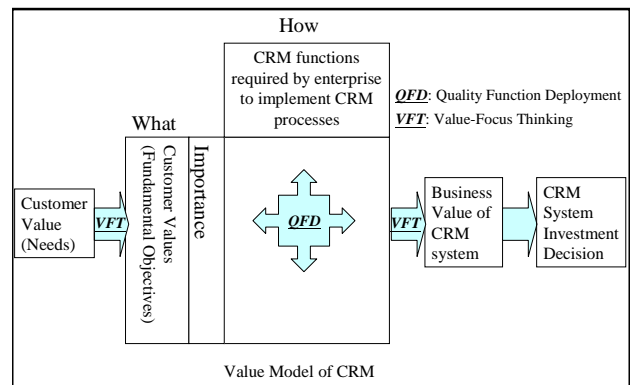


Figure 4 Implementation of VRM Value Model

The value model can provide the foundation for developing a quantitative model of CRM system values. Keeney develop an equation to quantify the customer value in his paper published in management science. Let  $O_1, \dots, O_n$  be the set of  $n$  fundamental objectives of a specific product or service. For each objective  $O_i$  let  $X_i$  be a measure that describes the product or service with respect to  $O_i$  and let  $x_i$  be a specific description. The vector  $x = v(x_1, x_2, \dots, x_n)$  provides a description of the product or service and the process to obtaining it. The customer value can be quantified as:

$$v(x_1, x_2, \dots, x_n) = \sum_{i=1}^n k_i v_i(x_i) \quad (2)$$

Where  $k_i$  is the weight that indicates the relative priority of objective  $O_i$  and  $v_i$  is a scaling of the relative desirability (i.e., value) of different values of  $O_i$ . During the process of QFD, the importance is the weight that

indicates the relative priority of deployment factors. The weight accumulation and conversion in QFD process could be very helpful to decide  $k_i$  for each value factor. The equation of business value is similar to the equation of customer value, but the fundamental objectives (value factors) are different. The business value can be quantified as:

$$v(y_1, y_2, \dots, y_n) = \sum_{j=1}^m k_j v_j(y_j) \quad (3)$$

The value model we defined in equation (1) can be further developed to the following equations:

$$V_{CRM} = V_{Customer} + (1 - ) V_{Business} \quad (4)$$

$$V_{Customer} = v(x_1, x_2, \dots, x_n) = \sum_{i=1}^n k_i v_i(x_i) \quad (5)$$

$$V_{Business} = v(y_1, y_2, \dots, y_n) = \sum_{j=1}^m k_j v_j(y_j) \quad (6)$$

Where  $k_i$  is the relative weight of  $V_{Customer}$ . Since there are only two components in  $V_{CRM}$ , the relative weight of  $V_{Business}$  is  $(1 - k_i)$ .

#### 4. Design of research framework for empirical study

The main objective of this study is to create an actionable process to measure the CRM system values and help enterprises to make decisions regarding CRM system investment. The above building processes and value model should be able to apply to different companies in different industries. In order to verify the validity of this value model, following the on-site interviews with the CRM system experts and users, an empirical study was designed and conducted.

The hypotheses of the empirical study are illustrated in Figure 5. The independent variables X1 and X2 are the two dimensions ( $V_{Customer}$  and  $V_{Business}$ ) of CRM value model developed by this study. There are 8 factors of customer values which are shown in Table 1. These 8 factors are measured by requesting the respondents to answer their perceived importance of each fundamental objective on a 5-point Likert scales. Both CRM experts and the pre-test result of survey suggest that CRM functions will be easier for people to compare the relative importance for business values measurement.

$V_{Business}$  is measured through 21 CRM system functions (see Table 3) instead of 10 fundamental objectives of business values. These 21 factors are measured by requesting the respondents to answer their perceived importance to their business for each CRM function on a 5-point Likert scales.

The dependant variable Y is the evaluation result of

CRM system. It is measured by the intension of investment on CRM system (i.e. the possibility of investment). Z is the possible moderator that might affect the validity of CRM value model developed in this study. We define Z as the industry of the respondents' enterprises. The classification of the industry is based on the industry code defined by Common Wealth in the annual survey of top 2000 companies at Taiwan.

The validity of the value model will be verified through the test of three hypotheses:

- H1: The investment possibility of CRM system is highly correlated with customer values.
- H2: The investment possibility of CRM system is highly correlated with business values.
- H3: The positive effect of customer values and business values on the investment possibility of CRM system is consistent for different industries.

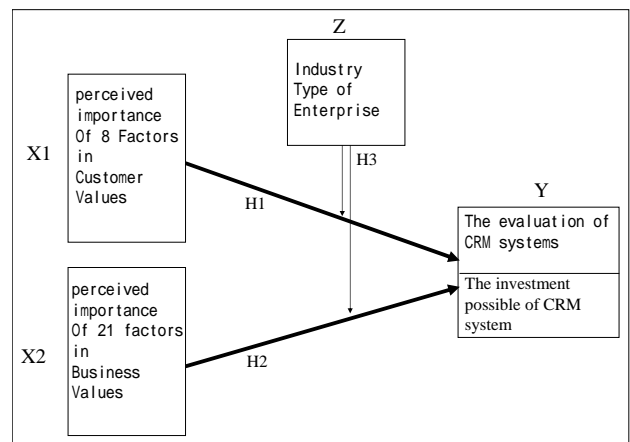


Figure 5 Hypotheses and model of empirical test

#### 5. Results of empirical study

The survey instrument was developed to fit the study based on the literature search, previous interviews with 12 CRM experts and a pilot test. The sampling frame includes a wide range of industries such as computers, electronics, mechanical, automobiles, chemicals, pharmaceuticals, etc. A stratified random sample of 1000 firms was chosen from the database of Common Wealth top 2000 firms of Taiwan. The questionnaires are sent to the managers who are responsible for, or highly involved in evaluating CRM system investment decisions. Two hundred and fifty three questionnaires were completed and returned (25.3% overall responses rate). One hundred and eighty eight questionnaires are usable (18.8%) after eliminated the invalid questionnaires due to missing data.

The Cronbach's alphas of construct X1 and construct X2 are 0.8963 and 0.8013. They are all above 0.70 and demonstrate adequate internal consistency [15]. A series of exploratory factor analysis were employed for the multi-items to further purify the measurement indicators. The method of principle components in conjunction with the latent root criterion, which demands factors with eigen values greater than 1 to be considered significant, was the technique for extracting factors. A cutoff value of 0.5 was

adopted as criterion for screening significant factor loadings. The results were listed in Table 5 and the construct validity is verified.

Table 5 EFA (Principal Component Analysis)

Comp.	Eigen Value	Factor Items	Factor Loading
Component 1	1.786	Offer multiple services	.644
		Assure reliable service	.637
		Minimize cost	.764
		Minimize time spend	.733
		Maximize service hours	.753
		Maximize convenience	.736
		Maximize safety	.786
		Maximize personal service	.639
Component 2	1.637	Member Registration/ Ident.	.646
		VOIP	.623
		On-line Chat	.732
		Email reply management	.760
		Email Auto Reply system	.804
		Web self-service	.779
		On-line help (search engine)	.708
		Sales Automation (Web sales)	.781
		Sales Order Management	.712
		Customer Profile Management	.808
		Data Analysis (Data Mining)	.812
		Workflow for service agents	.798
		General database search	.844
		Service Knowledge database	.804
		Service Performance mgmt.	.850
		MRO scheduling and control	.754
		Support New Product Develop.	.807
		Promotion/Campaign mgmt.	.771
		Support Tel-sales Mgmt.	.767
		Support Direct Sales Mgmt.	.791
Support New Product Develop.	.762		

When  $\alpha = 0.01$ , the correlations among independent variables and dependent variables are highly positive (see Table 6). The positive correlations are consistent across industries. The 188 valid questionnaires covered 16 industries. Since the distribution of the samples in different industries is not the same, the number of samples in several industries is less than 5. A Median Test is conducted to verify the hypotheses H3. The median test result shows  $p = 0.25$  is higher than  $\alpha = 0.01$  (see Table 6). This test result confirmed that different industries had same distribution possibility on the CRM investment possibility. The numbers of samples in different industries did not affect the validity of correlation analysis.

Table 5 Correlation Analysis

Independent Variables	CRM investment possibility	
	Pearson Correlation	Sig. (2-tailed)
Customer Value	0.67	0.00
Business Value	0.73	0.00

Table 6 Median Test

The possibility of CRM system investment	
N	188
Median	1.00
Chi-Square	18.32
df	15.00
Asymp. Sig.	0.25

## 6. Conclusions

The main contribution of this paper is the actionable process to measure the CRM systems value. Different companies can follow the above building processes and create their own value model. Through the value-focus thinking and QFD methodologies, enterprises can understand their customer better and find out the customer values of their product or services. There are several important potential applications of the proposed model: it can help the firms to evaluate the CRM system investment, and it can be used as a decision making tool for adopting priority of various CRM functions as well as for improving the customer management processes.

For academic research, it is still a long way to create a complete value model and to prove the effectiveness of the value model. The equations (4),(5) and (6) could be further developed to compute based value evaluation system. There is not solid theory development and test for the value model and the building process. This study is just a start point. More empirical researches or case studies might be helpful to further develop the research framework.

## 7. Appendices

Due to the size and format issues, the appendices are attached after references.

Appendix 1- Level 1 of the house of quality

Appendix 2- Level 2 of the house of quality

Appendix 3- Level 3 of the house of quality

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- ⊙ : Strong positive: 9 points
- : Medium positive: 3 points
- ◆ : Medium negative: 1 points

	Maximize access to information	Assure system security	Minimize fraud	Maximize service information	Min. misuse of personal information	Assure reliable service	Limit unsuitable service	Maximize . accuracy of transaction	Enhance comparison service	Make better service choice	Maximize service availability	Maximize service variety	Maximize ease of use	Offer personal interaction	The importance of customer needs
	+	+	+	+	+	+	-	+	+	+	+	+	+	+	
Offer multiple services															
Assure reliable service															
Minimize cost															
Minimize time spend															
Maximize service hours															
Maximize convenience															
Maximize safety															
Maximize personal service															
<b>The absolutely importance of enterprise means objectives (%)</b>															
<b>The relative importance of enterprise means objectives (%)</b>															

X : Interviewee  
 Y : Competitor-1  
 Z : Competitor-2  
 競争者 (2)

Customer perceptions	
	1 2 3 4 5
X	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Y	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Z	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
X	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
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Y	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Z	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Appendix 1 Level 1 of the house of quality



- ◎ : Strong positive: 9 points
- : Medium positive: 3 points
- ◆ : Medium negative: 1 points

	Member Registration/Indentification	V O I P	On-line Chat	Email reply management	Web self-service	Email Auto Reply system	On-line help (search engine)	Sales Automation (Web sales)	Sales Order Management	Customer Profile Management	Data Analysis (Data Mining)	Workflow support for service agents	General information database search	Customer service Knowledge database	Service Agents Performance management	MRO planning, scheduling and control	Market Research Support	Support New Product Development	Promotion/Campaign management	Support Tel-sales Management	Support Direct Sales Management	The importance of CRM process		
Acquiring/leveraging information technology/system for customer contact																								
Learning about product usage and application																								
Determining the needs of existing and potential new customers																								
Managing customer site visit teams																								
Developing/executing advertising programs																								
Developing/executing promotion programs																								
Developing/executing sale programs																								
Developing/executing service programs																								
Cross-sell and up-sell of product service offerings																								
Enhancing trust and customer loyalty																								
Identifying potential new customers																								
<b>The absolutely importance of CRM functions (%)</b>																								
<b>The relative importance of CRM functions (%)</b>																								