A Study on the Influencing Relationship of Key Factors in CRM

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Abstract. In today's highly competitive business world, customer relationship management (CRM) is emerging as a core marketing activity. Based investigation of the factors that influence the customers' willingness to engage in a relationship（CWER）and the customer relationship share (CRS), a conceptual model is derived by using theories taken from multi-disciplinary literature, including marketing, management, information systems, and e-commerce. It is mainly tested to determine (1) the effect of CWER and the customer satisfaction (CS) on CRS; (2) the effect of customers' attitude toward the firm on CWER; and (3) how customers' knowledge and belief about CRM program affect customers' attitude. Finally, this study also provides a framework for several avenues for scholarly research and lays a foundation for future research aimed at enhancing extant knowledge about factors influencing CWER and RS.

Keywords: *Customer relationship management (CRM), Customer satisfaction (CS), Customers' Willingness to engage in a relationship (CWER), Customer relationship share (CRS)*

1 .INTRODUCTION

In today's highly competitive business world, both CRM and excellence in customer service are strategically important. Some researchers have analyzed customers' lifetime behavior in contractual contexts [1]. However, research is scarce on how to enhance CWER and RS [2] with the firm. The need to focus on CWER and RS, and, thus, to measure the CRM effectiveness, has been strongly expressed by scholars [3].

The objective of this study is to identify the important determinants of CWER and RS and to empirically test if CWER enhance RS. This study proposes a conceptual framework, develops and tests a model to explain the antecedents of RS and CWER with the firm and how SAT, leads to RS.

2. LITERATURE REVIEW

Identifying customers and establishing relationships with them has made a great leap forward during the past decade. But, little is known regarding the identification of the drivers of CWER and RS. Customer satisfaction, trust, commitment, and customers' experience with the firm have become focal constructs in relationship marketing research [4-7]. But, there are few scholarly studies that discuss the factors that enhance CWER and RS in the context of CRM. Research has shown that in CRM, customer' attitude toward the firm is one of the most important factor in establishing CWER with the firm [5], which leads to increase in RS. Customer RS can also be enhanced by increasing customer satisfaction and their CWER with the firm.

We propose a research model, shown later in Figure 1, which illustrates relationships between key factors in CRM. Three theoretical perspectives are used to support this study: commitment theory given by Becker [8], attitude representation theory [9-10], and planned behavior theory [11-12].

3. SAMPLE CHARACTERISTICS

The sample consists of customers own a cell phone. An online data collection firm assisted in data collection. From a sample frame of 30,094 customers, the online firm sent the questionnaire to 2,148 customers, using a random sampling method. The sample frame comprised customers from all parts of China.

A total of 2148 emails were sent to the subjects, 585 completed and submitted them. Thus, the response rate for this study was 27.2%. The subjects for the study consisted of slightly more female (55%) than male (45%). The youngest participants were in the age group 18-24 years which constituted 5.5% of the total responses whereas the majority of the participants in this study were in the age groups of 35-44 years, 45-54 years, and 55-64 years which constituted 21.7%, 25.1 %, and 22.2% of the total responses. A majority of the subjects, approximately 84% for this study, fell in the last four educational categories (some college and beyond), thus indicating that a large number of respondents were highly educated. Approximately 40% of the respondents had a household income between ¥50,000～¥99,999.

4. STRUCTURAL MODEL AND ANALYSIS

4.1 Structural Model

Five constructs (satisfaction, customer knowledge and belief about the CRM program, customers' attitude toward the firm, customers' willingness to engage in a relationship, and relationship share), and seventeen measured variables were used for model testing. Since the normalized estimate of multivariate kurtosis was found to be 91.55 in the proposed model, which exceeded the recommended cutoff point of 3, Robust Maximum Likelihood (ML) estimation method, as suggested by Schumacker and Lomax [13], was used for model testing.

Multiple fit indices, as suggested by Schumacker and Lomax [13], were used for assessing the model fit of the final revised structural model. The results indicated that the overall fit indices of the structural model (Figure 1) were excellent, indicating a close fit. The Satorra Bentler Chi square ratio (S-B x2 /df) statistic of 2.23 was found to be within the acceptable range of 3. The other fit indices also indicated a close model fit. All the fit indices, including incremental fit index (IFI), comparative fit index (CFI), and non-nonmed fit index (NNFI) values, were above .90 as recommended by the literature. The root mean square error of approximation (RMSEA) was below 0.05 thus indicating a close model fit [14-15]. Table 1 shows the summary statistics, model fit, of the final revised model.

Table 1. Summary Statistics of the Final Revised Model

Fit Indices	Acceptable level	Threshold level	***Final revised model***
S-B Chi-square/df	1 to 3	<3	2.23
CFI	0 (no profit) to (perfect fit)1	>0.90	0.980
NFI	0 (no profit) to (perfect fit)1	>0.90	0.964
NNFI	0 (no profit) to (perfect fit)1	>0.90	0.975
RMSEA	0 (no profit) to (perfect fit)1 (acceptable fit)	<0.08	0.046

4.2 Testing of the Hypotheses

Testing of the hypotheses involves confirming that a theoretically specified model fits sample data. The causal relationships between the five constructs were examined. The proposed/base model is shown in Figure 1 .Five hypothesized paths (parameters) were tested for significance in this study. The summary of the five hypothesized paths are shown in Table 2.

First the directionality of the parameters were examined to determine whether they have the correct sign (either plus or minus) and then the magnitude of the paths (or parameter estimates) between the constructs were examined to determine whether they were out of bounds or exceeded an expected range of values [13].

Once the directionality and magnitude were examined then the statistical significance of the hypothesized paths (parameter estimates) were investigated by examining the path coefficients, t-value, and standard error (SE). The paths (or parameters) estimates of the structural model are shown in figure 1.

Table 2. Summary of Hypotheses

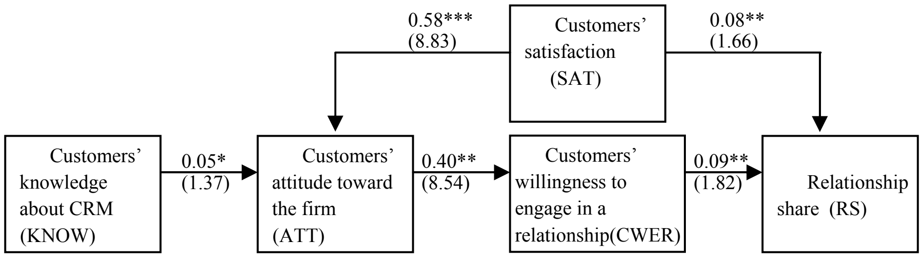
Hypotheses	
H1:CWER→RS	The greater the customers' willingness to engage in a relationship (CWER) with a firm, the higher the customers relationship share (RS) with that firm.
H2: SAT→RS	The higher the customer satisfaction (SAT), the greater the customers relationship share (RS) with the firm.
H3: SAT→ATT	The higher the customer satisfaction (SAT), the more positive their attitude (ATT) toward the firm.
H4: KNOW→ATT	The greater the customers' knowledge and belief about a firm's CRM program (KNOW), the more positive the customers' attitude (ATT) toward the firm.
H5: ATT→CWER	The more positive the customer's attitude (ATT) toward a firm, the greater the customer's willingness to engage in a relationship (CWER) with the firm.

Note: RS=Relationship share;
CWER=Customers' willingness to engage in a relationship
ATT=Attitude;
KNOW=Knowledge
SAT=Satisfaction

4.3 Parameter Estimates or Path Analyses

Five hypothesized paths, between the five latent constructs (satisfaction, knowledge, attitude, willingness, and relationship share), were tested for significance. According to different studies [16-17], a path is considered significant if the t-value (parameter estimates divided by standard error of the parameter estimates) is significant. If the parameter estimate is positive and significant, it indicates that there is a positive relationship and if the parameter estimate is negative and significant, it means that there is inverse relationship between the constructs.

The result indicated that all the five hypothesized paths that were tested, in this study, were significant and the directionality of all those significant hypothesized paths was positive. The result for the structural model is shown in Figure1. The structural model shows the significant paths. Out of the five significant paths, two paths (SAT→ATT and ATT→CWER) were significant at 0.01 level and the t-values for those two paths were 8.83 and 8.54 respectively. Two paths (CWER→RS, and SAT→RS) were significant at 0.05 level. The t-values for those significant paths were 1.82 and 1.66 respectively. One path (KNOW→ATT) was significant at 0.10 level and the t-value was 1.37.



*p<0.1; **p<0.05; ***p<0.01

Figure 1. Key Factors Relationship Model

Figure 1 shown above presents the model and structural path coefficients for each relationship. The structural model result indicated proposed at $p<0.01$, $p<0.05$, and $p<0.10$ levels.

It supports all the five hypotheses as below:

Hypothesis 1, predicting a positive relationship between customers' willingness to engage in a relationship (CWER) and relationship share (RS) was supported. The results revealed that the path between these two latent variables was positive ($\beta32=0.09$) and significant ($p<0.05$), thus supporting hypothesis 1.

Hypothesis 2 and 3 are related to satisfaction. The analysis indicated a significant direct effect for satisfaction (SAT) to relationship share (RS) and customers' attitude toward the firm (ATT). Test results indicated that satisfaction (SAT) has direct effect on relationship share ($\gamma23=0.08$; $p<0.05$) and customers' attitude toward the firm ($\gamma21= 0.58$; $p<0.01$). Thus, hypotheses 2 and 3 were supported.

Hypothesis 4 predicting a positive relationship between customers' knowledge and belief about the CRM program (KNOW) and customers' attitude (ATT) was supported. Test results revealed that KNOW has direct effect on customers' attitude ($\gamma11= 0.05$; $p<0.1$) and is significant, thus supporting hypothesis 4.

From Figure 1 above, it can be said that customers' attitude (ATT) toward the firm was a predictor of customers' willingness to engage in a relationship (CWER), which supports hypothesis 5. The path between these two latent constructs is positive ($\beta12=0.40$ $p<0.01$) and significant.

Thus, results revealed that five hypothesis were supported.

5. CONCLUSIONS

To reduce the high failure rate of CRM program, this study provides important insights for managers. The results shown in the model developed for this study suggest that managers may be able to influence the achievement of desired outcomes from a CRM program in ways. It also have identified important factors which can be used by managers formulate marketing strategies aimed at achieving CWER and higher customer RS.

Firms should devote more attention to developing and maintaining relationships with customers which enhance customer satisfaction. This enhancement of customer satisfaction should result in: (1) positive attitude of the customers toward the firm; (2)

an increase in customers' willingness to engage in a relationship (CWER) with the firm, and (3) increased customer relationship share (RS) for that firm. Overall, this strategy should enable firms to maximize customers' repeat business and subsequent profits.

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An Approach to Enterprise Application Integration Based on Ontology Semantic Description

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Abstract. This paper systematically provides an enterprise application integration (EAI) approach for the complex product design industry in which the application integration has long been difficult. In addition, the complex product's data sources are distributed in different enterprise application systems which resulted in the design ontology's heterogeneousness. Similarly, the differences in enterprise application systems bring about the heterogeneousness of the application ontology. Based on an actual project, this paper studies the nonobjective characteristic of the heterogeneous design ontology and heterogeneous application ontology in the complex product design industry, and establishes the common semantic description models for the two types of ontology respectively. In the actual project, an information system is developed and has been successfully applied to an enterprise.

Keywords: *Enterprise application integration (EAI), Ontology, Web services*

1. INTRODUCTION

With the development of information technology, the prevalence of enterprise information systems brings about higher efficiency as well as some new problems to the enterprises. The implementations of a variety of enterprise information systems need the support of the enterprise's existing resources and applications and consequently bring new challenges to the enterprise. Enterprise Application Integration (EAI) was brought under these conditions and it has changed with the continuously development of Web Services. The rise of XML and Web Services provides a new direction for EAI [1].

EAI is defined as the integration of the process, software, hardware and standards of different application systems, making the systems operate seamlessly in the bound of an enterprise. EAI not only supports the integration of the internal application systems but it also supports the integration of different enterprises' application systems [2].The models of EAI includes three layers: the integration in the representation level, the integration in the data level, the integration in the function level.

There are a great deal of data stored in different ways in the enterprise due to the different stages of information systems implementation, the technologies used by the information systems and some human factors. These data compose the heterogeneous data sources. The heterogeneousness of the enterprise's data sources is exhibited as follows:

1. The different data sources use different terms to represent the same concept.
2. The same term expresses different meanings in different data sources.
3. There are various relations between the concepts in different data sources, but due to the autonomy of the distributed data sources, the implicit relations are not been exhibited (e.g. the inconsistency of the measurement).

Ontology describes the meanings of concepts accurately, describes the implicit relations between the concepts and acquires the implicit relations through logical reasoning. It has powerful capabilities to represent the semantics of the concepts and acquire knowledge. Hence, Ontology is used to solve the problem of heterogeneous data [3]. This paper systematically provides an enterprise application integration (EAI) approach for the complex product design industry in which the application integration has long been difficult. A Complex product is a type of product with complex consumer demands, complex components, complex manufacturing process, complex experiment and maintenance process, complex project management and complex work environment, such as air crafts, airplanes, automobiles, and ships, complex mechanical and electronic products and so on.

2. EAI BASED ON ONTOLOGY SEMANTIC DESCRIPTION

Ontology is a concept originally coming from philosophy, and it describes the objective existence of a system and concerns the abstract nature of the objective reality. In the artificial intelligence field, the first definition of Ontology was given by Neches et al. In their literature [4], the Ontology was defined as nomenclature, relationships and the definition that use these terms and relations constitute the vocabulary extension of these rules in related fields. In the artificial intelligence field, Studer's definition about Ontology was generally accepted. Knowledge ontology is a clear formalization specification of the shared conceptual model. This definition includes four levels of implications [5].Based on Figure 1 , the current research of Semantic Web mainly focuses on ontology layer. The precise meaning of Ontology is achieved by the strict definition of concepts and the relationship between the concepts. Ontology is a clear conceptual model of the specification [6].So in the field of Semantic Web, ontology lies in a very important position and is the basis to solve Web information sharing and exchange in semantic level. Ontology technology and other artificial intelligence technologies rely on the knowledge representation and reasoning technology, but ontology-based system is different from the knowledge base systems, expert systems and the main technology (Agent Technology) system significantly in the following aspect. Ontology description puts more emphasis on data sharing. Ontology expresses the general sharing knowledge but not some personal data. Currently, the common ontology languages are OIL [7], DAML+OIL [8] and OWL.

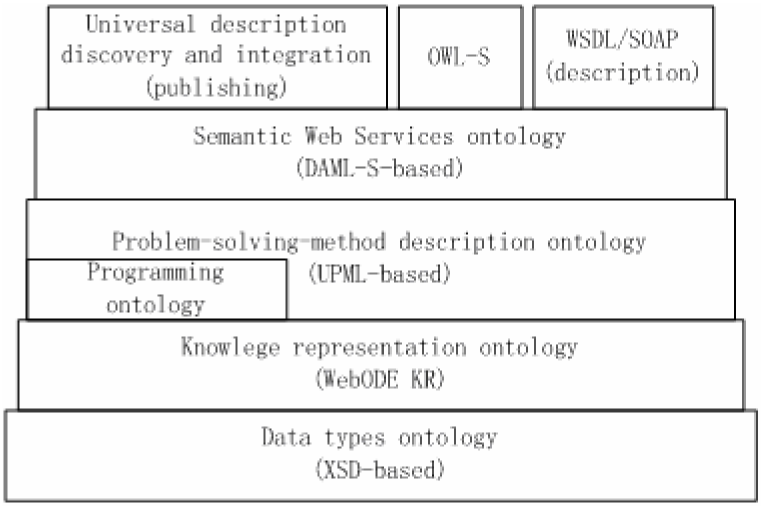

Figure 1. The Framework for Semantic Web Services based on Ontology

3. DESIGN OF EAI AND REALIZATION IN AN ENTERPRISE

The goal of data integration of heterogeneous data sources is to provide integrated, unified, secure and easy access to information inquiries, data mining and high-level decision-making for enterprise application systems. To meet the requirements, the integrated data must have a unified data model with integrity, consistency and security. Ontology is the basis of concept share, and it helps us to explain the data consistency [8]. We adopt the global ontology base to solve the problem of heterogeneous data sources of enterprise application systems. The framework diagram is shown in Figure 2. The functions of every layer are explained as follows:

1. The Information source layer is the enterprise data provider to provide data in various storage formats from various enterprise application systems.
2. The Middleware layer composed of wrapper and inquiries engine converts the heterogeneous data into XML or converts XML into heterogeneous data by constructing wrappers for the different data sources so as to establish a two-way mapping.
3. The XML interface layer is responsible for the communication between the users.
4. The Data integration layer is to create a global ontology to change the heterogeneous data packed and stored in different wrappers into a unified data format in order to eliminate the differences between the syntax and semantics.
5. The Information services layer is to apply the integrated data with integrity, consistency and safety.

XXX.Electric Co., Ltd. was founded in 1958, and it has become one of the largest companies specializing in manufacturing large electronic products. With the rapid increase of the demand of the products, how to optimize and integrate the original product design flow has become an important problem. After an analysis of the design flow of the products, some problems were found in the field of product design.

The calculating software used for designing and calculating the parameters of the products is independent. The designer must write a great deal of data at each step for the calculating software. The outputs of the calculating software are txt files and graphics files. There is no comparison, filtering and optimization between the outputs.

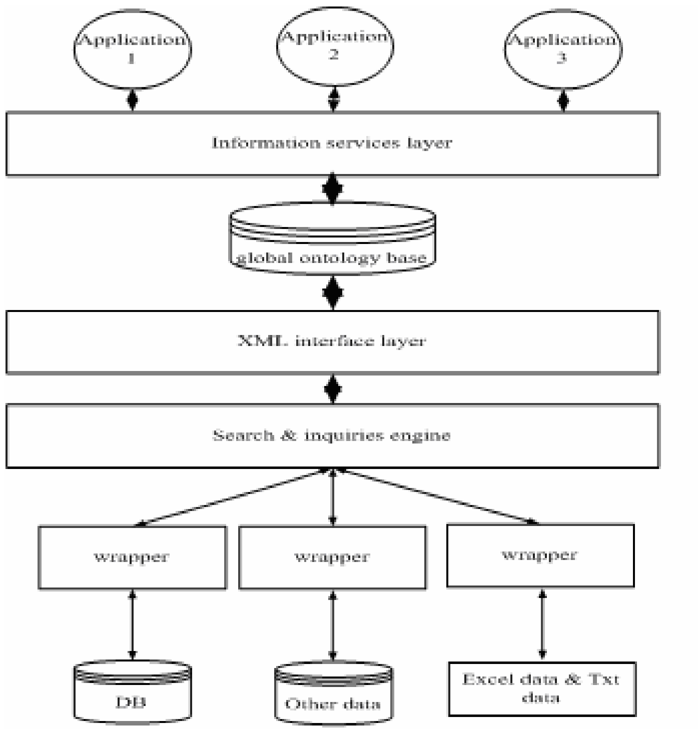

Figure 2. The Framework based on the Global Ontology Base

Based on the above problems, the Extensible Electrical Product Design Integration Environment is designed. Figure 3 shows the problem-solving framework of the Extensible Electrical Product Design Integration Environment. The framework uses ontology-based scalable module definition format language (SMDFL language), relevant data storage and Web services to realize the extensible model of the electrical product integration design platform. SMDFL supports the description, storage, retrieval and validation of complex data, provides scalability for the calculation process, supports the optimization of data retrieval and helps the data storage model to support generic application program interface (API). The effective integration of SMDFL engines and data storage can support metadata management, derivative data management, database management, modern intelligent graphical user interface, the tools of scientific visualization and analysis and the effective realization of case-based reasoning system. Electrical Product design integration environment based on the service-oriented framework has the characteristics of high scalability and loose coupling. Electrical Product design integration environment provides a unified graphical user interface to facilitate the integration of various software modules. By using the various functions of electrical product design integration environment, designers can achieve the efficient storage, retrieval, analysis and reuse of the large amount of electrical product design cases in the design lab to support the Decision Support System based on the case-based reasoning[9].

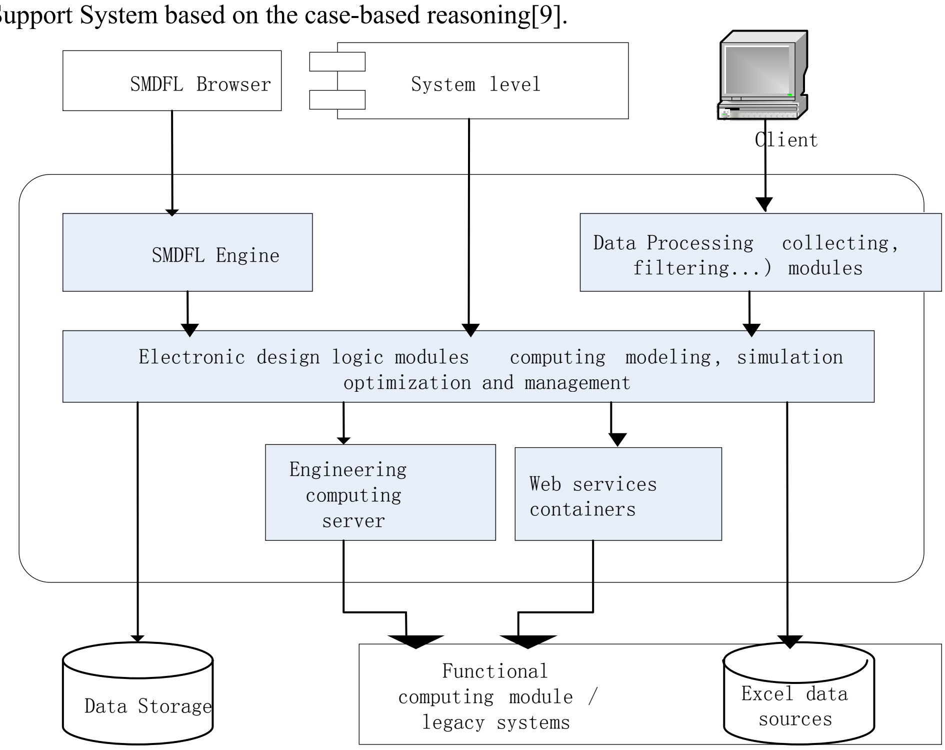

Figure 3. The Framework of Electrical Product Design Integration Environment

4. CONCLUSIONS

This paper proposes a method of enterprise heterogeneous data integration based on ontology, which can solve the problem of Information Island and process the heterogeneous data sources in enterprise application integration. This method not only saves the human resources and financial resources of the enterprise, but also ensures the update of enterprise application systems. The author and his project team members designed an EAI platform and successfully applied to an enterprise on the basis of the ontology-based EAI method.

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