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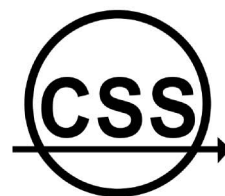


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e-CRM Development Method for e-Commerce System Owned by Small Medium Enterprises

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Abstract—While it is known that to promote business success, e-commerce systems must be supported by effective e-CRM (*Electronic Customer Relationship Management*), our survey results indicate that Indonesian e-commerce systems owned by SMEs have not provided effective-intelligent e-CRM services. In this paper, we propose an evolutionary e-CRM development method suitable for SMEs that include activities of enhancing the existing e-commerce systems to capture more needed data, data ware house development and e-CRM application development. The method has been being implemented in a case study firm and we find that it is applicable.

Keywords-component: *Electronic Customer Relationship Management in e-Commerce; Evolutionary Development Methodology*

I. INTRODUCTION

Small Medium Enterprises (SMEs) play significant roles in Indonesia economy as they contribute significantly in higher growth of employment and Gross Domestic Product (GDP) [13]. Along with the Internet growth, many SMEs have used or run Business-to-Business (B2B) and a variety of Customer-to-Customer and Business-to-Customer e-commerce systems, such as e-tailer, transaction broker, service provider, and so on. However, we find that the SMEs have not “optimized” their systems¹. While it is known that to promote success and compete with other firms the e-commerce systems must be supported by effective e-CRM (*Electronic Customer Relationship Management*), the SMEs’ e-commerce systems still significantly lack of e-CRM features.

CRM is the strategy for building, managing, and strengthening loyal and long-lasting customer relationships [11]. Its scope should be the “personalized” handling of customers as distinct entities through the identification and understanding of their differentiated needs, preferences, and behaviors. Therefore, in e-commerce systems e-CRM should include personalized services, such as personalized web pages, newsletter, email messages and recommendations.

Contrarily to the fact that most e-commerce systems in developed countries have provided highly personalized services, through some survey we find that Indonesian e-commerce systems owned by SMEs still lacks of such

services. These systems currently only accommodate limited e-CRM features (see Section III.A for detailed results). By regarding the survey result presented in [2], where 68% of customers who churn are due to lack of personal attention, we view that providing an intelligent e-CRM system, which provides personalized services, in e-commerce systems is significant.

After studying published research results, we have not found any literature that discusses effective e-CRM systems development method applicable for small to medium e-commerce systems in Indonesia. Every effective e-CRM system needs intelligent system incorporating data warehouse, data mart and data mining techniques. Hence, developing such system involves complex processes. SMEs, on the other hand, are specific business entities having specific constraint and organizational conditions such that they need specific e-CRM systems and development methods suitable for them. Therefore, this research aims to contribute in proposing a method of e-CRM systems development that is suitable for SMEs.

¹ In the case of the B2B e-commerce, the problems can be found in [8].

II. LITERATURE STUDY

A. CRM Systems in e-Commerce

In e-commerce systems, CRM systems are part of the marketing technologies [5]. A complete CRM system includes major components of customer touch points, data source, data aggregation and marketing automation (see Fig. 1).

In the system: Touch points (including operational information systems with features of call centers, help desks, sales automation, self-service activities, such as FAQs campaign management and general-purpose e-commerce applications) produced the operational data; data aggregation includes organizational data warehouse that merges operational, external data and customer data repository; marketing automation includes specific customer related data needed for CRM (stored in data marts), OLAP and reporting, and applications used for marketing automation. Among the applications are [6]:

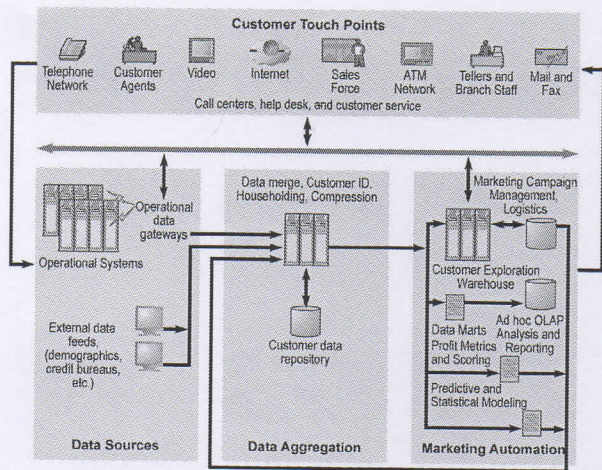


Figure 1. A CRM system [5]

- (1) Applications for analyzing customer data to measure, predict and interpret customer behavior;
- (2) Applications for managing promotions;
- (3) Applications for personalizing messages (in text as well as HTML format) and automating the messages delivery. Data mining techniques (clustering, classifications, frequent patterns and association rules analysis, and so on) can be used in the applications for finding patterns in data and modeling behavior of customers.

B. Data Warehouse and Data Mart Development

A data warehouse is a subject-oriented, integrated, time-variant and non-volatile collection of data in support of management's decision making process [4]. A data warehouse is populated from the operational databases and other sources by ETCL (*extract, transform, clean and load*) functions. A data mart is a small, single-subject data warehouse subset that provides decision support to a small group of people. Each data mart usually takes a portion of the data warehouse and is designed to handle the needs of a specific department or part of the enterprise [9].

There are two approach in developing data warehouse, which are top-down and bottom-up. It is found that the top-down approach is costly and high risks, therefore is not commonly practiced. The bottom-up approach has three main stages, which are ([3] and [9]):

- (1) Defining objectives and development planning;
- (2) Infrastructure planning;
- (3) Planning and developing data marts: each cycle produce a new data mart, which is added to the data warehouse along with its required functions.

There are two approaches in developing data marts:

- (1) *Data-driven* or *supply driven*: Based on the available data, groups of relevant data are selected, data structure and application functions are then designed;
- (2) *Requirement-driven* or *demand-driven*: Business objectives are defined, then, the objectives are "mapped" into data structured and ETCL functions.

C. Evolutionary Database Development

In general, information systems such as e-commerce systems need to be enhanced or even reengineered from time to time to resolve requirement changes. In addressing such needs, the methodologies adopted usually are all evolutionary in nature, requiring developers to work both iteratively and incrementally. An e-commerce system has an important component, a database, which is also need to be redesigned along with the application developments. In such situation, evolutionary database development is needed with the following techniques [1]:

- (1) Database refactoring: Evolve an existing database schema a small bit at a time to improve the quality of its design without changing its semantics;
- (2) Evolutionary data modeling: Model the data aspects of a system iteratively and incrementally to ensure that the database schema evolves in step with the application code;
- (3) Database regression testing: Ensure that the database schema actually works;
- (4) Configuration management of database artifacts: The data models, database tests, test data, and so on are important project artifacts that should be managed;
- (5) Developer sandboxes: Developers need their own working environments in which they can modify the portion of the system that they are building and get it working before they integrate their work with that of their teammates.

III. SURVEI

The purpose of the survey is to find the facts of e-CRM services that have been practiced by e-commerce websites own by Indonesian SMEs and the organizational conditions of the SMEs.

A. E-CRM Services in the SME e-Commerce Systems

In this survey, we evaluate e-CRM application features in 16 e-commerce websites owned by SMEs in Indonesia consisting of 2 e-tailer, 5 transaction broker, 3 community provider, 2 portal, 2 content provider, 2 service provider and 2 market creator websites. For anonymity, we do not provide the name of the websites here.

In evaluating the websites, we explored, used/tested the e-CRM features in every website and recorded the working features. For analytical purpose, we group the services by following [12] as shown in Fig. 2. The descriptions of each group are as follows:

- (1) Customer-facing applications (CFA): Include features where customers interact with the company such as call centers, sales automation and field service automation (they basically automate information flow or support employees in sales or service);
- (2) Customer-touching applications (CTA): Include features where customers interact directly with the applications such as personalized web pages, self-service activities, FAQs, campaign management and general-purpose e-commerce applications;
- (3) Customer-centric intelligence applications (CCIA): Include features where intelligent systems (using data warehouse, data mining, and so on) are used to provide personal services or recommendations.

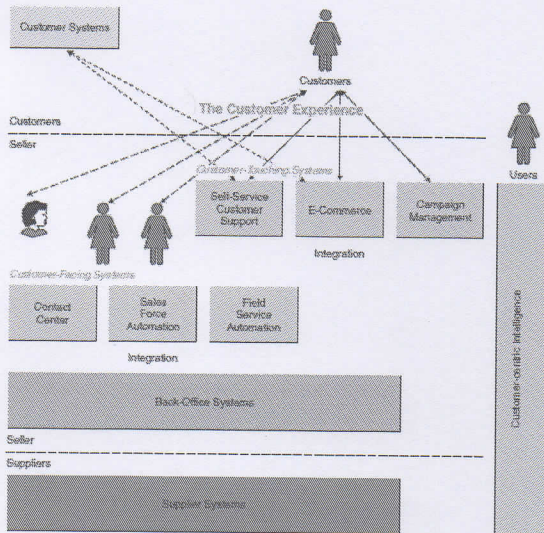


Figure 2. CRM applications [12]

From the evaluation, we find CFA and CTA features that are listed in Table I. None of CCIA features are found, therefore no feature can be presented here.

TABLE I. CFA AND CTA FEATURES FOUND IN THE SME E-COMMERCE WEBSITES

Category	CFA	CTA
E-tailer	Customer service and support (chatting, email, phone, sms, line, kakao talk, Whatsapps, etc), Social media (Facebook, Twitter, etc.)	Product catalog, advanced search (with many filter options), shopping cart, tracking order, reviews, recommendation item, recently viewed item, newsletter, FAQ
Transaction broker	Customer service and support (chatting, email, phone, text, line, kakao talk, Whatsapps, etc.), Social media (Facebook, Twitter, etc.)	Product directory or product catalog, advanced search (with many filter options), recommendation, FAQ, newsletter, wish list
Community provider	Contact us form/email, Social media (Facebook, Twitter, etc.)	Forum, advance search, news/article
Portal	Contact us form/email Social media (Facebook, Twitter, Google+, etc.)	News index (with many categories), integrate package of content and services (news, email, calendars, etc.), gateway to other sites
Content provider	Contact us form Social media (Facebook, Twitter, Google+, etc.)	Articles that are grouped into categories
Service provider	Contact us form/email, telephone, fax Social media (Facebook, Twitter, Google+, etc.)	FAQ, service information for merchants and customers
Market creator	Contact us form Social media (Facebook, Twitter, Google+, etc.)	Product directory with advanced search (with many filter option), promotion area

CFA: Customer-facing applications; CTA: Customer-touching applications

Other than evaluating the CFA and CTA features, we also evaluate the completeness of customer profile data of those

websites and bounce rate percentage of the websites. The completeness of customer profile data is evaluated by examining the user profile forms (that must be filled by users or members). The bounce rate percentage of a website is generated from <http://www.similarweb.com/>. The percentage number is counted by dividing the number of users who entered a website on a page and left without visiting any other pages and the total number of users who entered the website on that page [7]. Hence, it measures the user interestingness of web pages in a website. A low bounce rate is generally a good thing as it indicates that users explore many pages during a visit. A high bounce rate, on the other hand, may be fine if the purpose of a page is just to show some information to users. As the metrics of "high" and "low" are relative measures, here we just present the number in percentage (see Table II).

We provide the summary of evaluation results of CFA, CTA, completeness of customer profile data and average of bounce rate, which are presented in Table II.

TABLE II. THE ASSESSMENT OF E-CRM APPLICATIONS IN SME E-COMMERCE WEBSITES

Category	#	CFA	CTA	Customer Data	Avg of Bounce Rate
e-tailer	2	high	high	low	25.5%
transaction broker	5	high	high	medium	38.8%
community provider	2	low	medium	medium	45.84%
portal	2	low	high	low	48%
content-provider	2	high	medium	low	76.2%
service provider	2	medium	medium	low	23%
market creator	2	high	medium	low	34.5%

The measures for CFA and CTA (low, medium and high) used in Table II are based on the measure that are depicted in Table III and Table IV.

TABLE III. THE MEASURE OF CFA AND ITS INCLUDED FEATURES

Measure	e-CRM Features in Applications
High	Customer service (live chat, telephone, fax, whatsapp, line, kakao talk etc.)
Medium	Contact form/ email, telephone, fax (office standard)
Low	Contact form only

TABLE IV. THE MEASURE OF CTA AND ITS INCLUDED FEATURES

Measure	e-CRM Features in Applications
High	E-commerce main function, Search and Comparison, Technical Information and FAQ, Campaign management (promo item, sale, recommendation, etc), Customization, Community system, Loyalty Programs,
Medium	E-commerce main function, Search and comparison capabilities, Technical information and FAQ
Low	E-commerce main function, Search and comparison

In an attempt to compare the assessment results (presented in Table II) with the e-CRM services provided by the e-commerce websites that have highly implemented e-CRM, we have also evaluated the e-CRM the services of a well known e-commerce website, which is Amazon.com. We find that this website

indeed provides complete and excellent CFA, CTA and CCIA services. Hence, the SME e-commerce websites have been far left behind in terms of providing e-CRM services.

From the survey results, it can be concluded that:

(1) The customer-facing application (CFA) and customer-touching application (CTA) features have been provided with various degrees of completeness (from low to high). Hence, SMEs in Indonesia have been having understanding that these CRM features are important;

(2) The SMEs e-commerce system has not implemented customer-centric intelligence applications (CCIA) features.

(3) The bounce rate shows that most SMEs have applied web analytic tool in their website's pages for recording users' activities in the websites. However, the limited personalized service indicates that the user click data on website is not used yet to provide advance and personalized services (such as recommended items, previous viewed items, etc). This correlates with the fact that the SME e-commerce websites have not provided intelligent applications.

B. SMEs Conditions

In order to design the e-CRM development method suitable for SMEs, we need to assess the SME conditions such that we can develop a method that is applicable for SMEs. In this research, due to resources limitation, we have only conducted surveys to assess few SMEs who already run information systems. They are 3 retailers, 2 distributors, 1 photo studio and 1 hotel room provider. In essence, the survey results are as follows:

(1) The SMEs have very limited IT staff in charge of system maintenance as well as development;

(2) With limited IT resources, they cannot afford high cost and lengthy system development. The SMEs hope that after spending some affordable resources and time, they can obtain a "working system" such that it can be deployed and evaluated.

We view that those survey results are applied to SMEs in general by considering the fact that all of the SMEs indeed have limited capital and employ small to medium number of employees.

IV. PROPOSED METHOD

Based on the survey results, it can be concluded that:

(1) All of the sample of SME e-commerce systems have not included proper and sufficient e-CRM systems;

(2) The existing SME e-commerce systems may lack of data needed for e-CRM, therefore, to facilitate e-CRM development, the touch point information systems should be enhanced to capture more complete data;

(3) The e-CRM development method that can be adopted by SMEs should consider the limited resources availability and the need to launch the working e-CRM features immediately.

Based on these conditions, we view that SME should develop on-demand e-CRM (such as discussed in [7]), where each e-CRM service is developed and implemented based on the current needs. To support the development of the on-demand CRM, we propose an evolutionary development method, which adopts evolutionary database development and bottom-up data warehouse development applying requirement

driven. The method consists of stages depicted in Fig. 3. This approach is designed such that each cycle of e-CRM module development requires a relatively short time frame.

The discussion of each stage of development is the following:

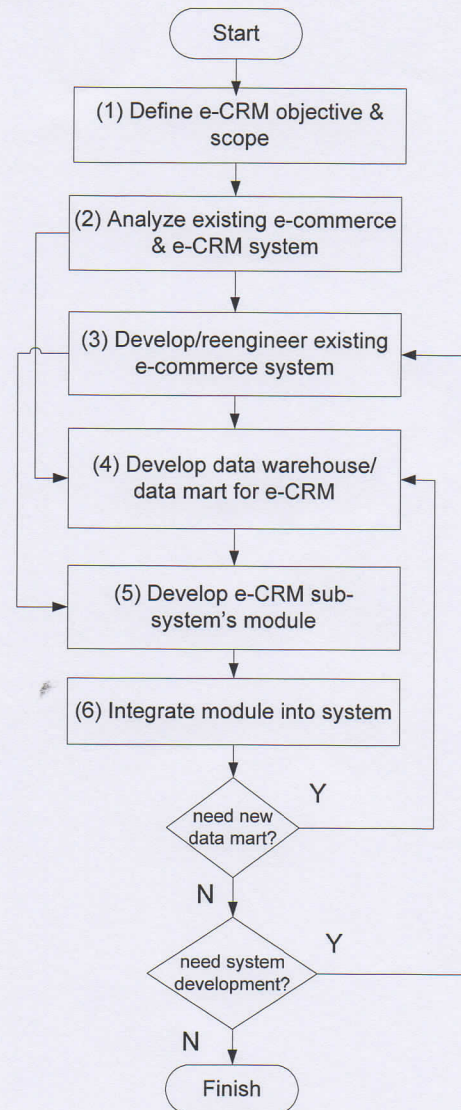


Figure 3. The stages of e-CRM development

(1) Define the e-CRM objective and scope

The application of e-CRM has been discussed in Subsection II.A. However, our survey reveals that in general SMEs concerns with their sales, therefore the objective and scope of the e-CRM can be started from e-CRM applications for marketing/campaign management, where the product offering and ads will be personalized based on the profile and activities of customers. At the marketing automation component (see Fig. 1), the e-CRM system should include features for web page personalization and electronic communication.

(2) Analyze the existing e-commerce and e-CRM system

Based on the objective and scope that have been defined, the existing system must be analyzed and assessed to define e-CRM application modules that need to be developed and to discover whether the data needed for the modules have been available in the database. If the data is fully available go to step (4) otherwise go to step (3).

In assessing the operational database, the following is the main concern: The data that will be analyzed using data mining techniques is the one related to customer profile and activities that must be complete, correct and recorded historically. The profile includes customer's demographic data while the activities include click data, various kinds of transaction, comments and reviews.

(3) Develop/reengineer the existing e-commerce system

To overcome the SMEs constraints (cost, development duration and the need to continually run the systems despite module changes), we propose the following scheme to develop the touch point information system.

As the priority data that must exist is customers' profile and their activities, in this stage, the development can be focused for capturing this data (in the touch point side) by providing relevant features and redesign the database. For faster development, we suggest that the development adopt prototyping paradigm with the following steps:

(a) Evaluate the database schema: The detailed data of customer profiles and activities are constructed, the result is used in improving the schema (designing additional tables or attributes, or modifying the existing tables, and designing the related relationships between tables).

(b) Implement database refactoring: The techniques discussed in Section 2 for developing database incrementally are adopted. In enhancing the database schema, the complete data model presented in [9] and [10] can be adopted and customized. In the model, business entities (customers, transactions, activities, and so on) have been modeled in such a way that anticipates changes in the future. Customization is needed such that the database complies with business rules and procedures of SMEs.

(c) Incremental application modules development and deployment: After the database schema has been enhanced, the priority of tables that will be "populated" can be defined. Modules with their specific features can be designed accordingly for capturing the data for the tables. On each module deployment, the existing system plus the new module must be kept on working properly.

(d) If not finished, go back to step (b).

(4) Develop data warehouse (data aggregation) for e-CRM

After the database contains sufficient data needed, the data warehouse supporting the e-CRM can be developed. In developing data warehouse for e-CRM with bottom-up and requirement-driven approach (see Section II.B), each data mart with specific data content that meets the objective defined in Stage (1) will be constructed in each cycle. The

data marts will include the ones that support product campaign, customer activities and need analysis, customers' value analysis, and so on. The data mart construction should include the ETCL (*extract, transform, clean and load*) processes design and implementation.

(5) Develop e-CRM sub-system's application module using statistical computations or Data Mining techniques

For analyzing the data, suitable statistical computations or data mining techniques must be selected/developed and employed in developing the appropriate e-CRM modules, which is in line with the objective and scope defined in Stage (1). If data mining techniques are employed, the stages of analyzing to obtain knowledge must follow the standard stages depicted in [4], which are selecting the needed data set, cleaning and transforming the data set, mining/analyzing the data set to produce patterns, then evaluating and selecting patterns to obtain useful knowledge. If statistical computations are adopted, the functions can access specific tables or views created in the database to facilitate the analysis. Each cycle of module development should automate a specific e-CRM module/service as defined in Stage (1), such as personalized web pages or product campaign services, and take the useful knowledge and customer profiles as the inputs. The module should be fully tested off-line (run in the development server and environment).

(6) Integrate the application module into the e-commerce system

The developed e-CRM module should then be integrated with the e-commerce system without taking the whole system down (or just taking it down for a brief time only). If all modules have been developed, then stop. Otherwise, go to Stage (3) or (4).

V. CASE STUDY

The proposed method is currently being implemented in our case study of e-commerce firm, which is KlikHotel.com. As a transaction broker selling hotel rooms, this firm has two types of "client" that should be managed: Customers who rent the rooms via the website and hotels who "supply" the rooms. Managing and strengthening relationships to the both clients are important in order to achieve business success. As the whole steps have not been completed yet, the following is the implementation of Step 1 to 5 of the proposed method in our case study:

(1) Define the e-CRM objective and scope: The top priority objective of the e-CRM is to maintain customers' and hotels' loyalty, increase their value and prevent them from churning. Hence the scopes of the e-CRM are: (a) Segmenting the customers as well as hotels based on their value, then design personal services for each segment (specifically for campaign management); (b) Detecting customers and hotels who tend to churn and then prevent them from doing so by providing special treatments (such as offering special deals, personal promotions, and so on);

(2) Analyze the existing e-commerce and e-CRM system: As the firm has been operating (selling hotel rooms) since 2010, the data of hotels and their activities, the data of customers, their activities and transactions have been historically recorded and stored in the database. After examining the database tables and their contents, we found: (a) The data of suppliers and their activities are quite complete and ready to be analyzed; (b) The data of customer profiles are incomplete, more demographic data need to be captured; (c) The customer data clicks, which can be analyzed to learn their behavior have not been recorded yet.

(3) Develop/reengineer the existing e-commerce system: In the first cycle, the modules to capture more customer demographic data and customers' data click are developed. The module is mainly designed to capture the log in time, IP address, website pages to be viewed, and the duration.

(4) Develop data warehouse and data mart for e-CRM: With bottom up approach, in the first cycle we are working with the data that are ready to be analyzed. We develop the following data marts: (a) For segmenting customers based on their value, the measures of the fact table are amount of booking transactions and staying (nights), where the dimension tables are customers, location (having attribute of city, region/province, country, etc.), time, hotel (having attribute of type, category and facilities); (b) For segmenting hotels based on their value, the measures of the fact table is the summary of daily booking transactions, where the dimension tables are location, time and hotels. ETCL modules are designed to "fill" the data marts.

(5) Develop Customer-centric intelligence applications (CCIA) application module: We are currently working in developing applications for marketing automation, which are: (a) Applications for analyzing customer data to measure, predict and interpret customer behavior; (b) Applications for managing promotions; (c) Applications for personalizing messages. For ensuring that we can develop useful applications using data mining, we conduct some experiments for analyzing the data stored in data marts. For segmenting customers based on their value, we "manually" extract and prepare the dataset (from the data mart) having the attributes of customer demographic attributes (gender, age, etc.) and their monthly total of transactions. Using binning techniques, we separated the valuable customers from the less-valuable ones. We then segment the valuable customers dataset using clustering techniques to obtain more specific segments. We have found some valuable patterns that further can be used to design personal messages and campaigns for each pattern.

Once we are finished with Step 5, we will integrate the application module into the e-commerce system.

VI. CONCLUSION AND FUTURE WORKS

Based on the SMEs conditions/limitations and priorities, a specific e-CRM system development method that is adoptable by SMEs need to be designed. Our proposed method addresses these issues by incorporating evolutionary development approach, where in each cycle include (possibly) enhancement of the touch point information systems including its database,

data warehouse/data marts development, e-CRM applications development and integrating the modules into the e-commerce systems.

In this research, we are implementing the proposed method in a case study firm. The steps have not been completed yet, but by implementing Step 1 through 5, we find that the proposed method is applicable. More works are needed to complete the steps and to measure the results. For future works, the methods should to be implemented in more case study firms. Then, e-CRM frameworks, including the design patterns of data warehouse, data marts, analytical tools (appertaining data mining techniques) and applications, which are adoptable by SMEs also need to be developed.

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