Enhanced CRM Systems for gathering product oriented customer features

H. Lasi, H. Baars, and H.-G. Kemper

Abstract— **In most industrial Small and Medium-sized Enterprises (SME) communication with customers is conducted exclusively by marketing, sales and service. Nowadays those business units apply Customer Relationship Management (CRM) systems to systematically gather information for the operational support of customer processes. Several studies illustrate that in the respective processes a vast body of additional information streams in directly from the customers, that *cannot* be collected in a *structured form* with current CRM systems. Examples include product demands, product experience or benefits of competitor-products. Moreover this information is only rarely transferred to the business units R&D and production. For those product oriented business customer knowledge is imperative for effective product development and enhancement. Without data integration across units' borders a valuable source of available customer information is neglected.**

This situation motivates the development of a concept for a solution that facilitates gathering product oriented customer data with CRM systems, and that enables a direct transfer into existing CAx systems. The solution utilizes feature technologies which are modified to enable the direct integration of "customer based features" into CAx systems. In this way, the voice of the customer can be immediately used to enhance product development and manufacturing processes.

Feasibility and validity of the concept are evaluated by building a prototype that enhances and integrates both a typical CRM system and a standard CAD system.

***Index Terms* — CRM, CRM integration, customer based product features, customer product knowledge management**

I. Introduction

The increasing stress of global competition forces Small and Medium-sized Enterprises (SME) in the industrial goods sector to carry out ongoing reengineering activities of manufacturing processes and to establish tightly integrated processes in the customer oriented business units marketing, services, and sales. For many SMEs a major building block for ensuring competitive strength is the introduction of a Customer Relationship Management (CRM) system that ideally creates a holistic view of the customer and assures consistent customer oriented processes [1].

Although there is a widespread implementation of CRM systems in customer oriented business units, a widely unnoticed lack of integration with product oriented information systems, that are also dependent on customer information, still remains [2][3][4]. This research aims at closing this gap efficiently by directly exchanging customer feedback between CRM and CAx systems.

II. Related Work

It needs to be acknowledged that there are already considerable integration efforts *within* the product oriented business units on the one hand and customer oriented units on the other:

On the product side there is a trend towards integrated product data management (PDM) and product lifecycle management (PLM) systems [5][6]. In the customer oriented business units customer based information systems are integrated into larger enterprise resource planning (ERP) systems [7]. It is nevertheless uncommon to provide functions for gathering product related knowledge from the customer with the purpose of exchanging it with R&D and production.

A common approach to tackle the information gap is known under the term "**customer knowledge management**" (CKM). CKM aims at gathering, organizing and sharing customer knowledge across an organization. Based on knowledge management in general, the focus of CKM is "customer knowledge" which encompasses both relevant information *about* and relevant information *from* the customer. Usually, CKM subsumes the implementation of an enterprise-wide customer knowledge management system and incorporates both organizational and technical measures. The current discussion in CKM research is primarily focused on aspects of the implementation and the usage of CKM systems. Recent CKM systems include functionality for process assistance with workflow management systems and knowledge discovery with text mining technologies [8][9][10].

Manuscript received July 30, 2007. This work was supported in part by Dassault Systemes and CAS Software AG.

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Another popular approach to transfer customer knowledge to R&D is the **Quality Function Deployment** (QFD) set of methods. The central idea of QFD is the translation of customer requirements into specifications for the engineer. The fundamental concept for this transformation is the "house of quality", which is used for the mapping of requirements to specifications. The actual elicitation of the customers demands is not part of QFD [11][12][13].

We propose a third approach to bridge customer oriented and product oriented business units: a *direct* machine-to-machine integration of established product and customer oriented information systems under consideration of the associated methods and data structures.

Especially for SMEs, integrating existing IT systems rather than introducing additional systems appears to be more attractive, because:

- marketing-, sales- and service staff members can gather customer knowledge with CRM systems they already integrated into their daily routine,
- R & D staff members and product managers obtain customer knowledge in their familiar CAx environment using their professional "language",
- sensitive customer data like sales opportunities does not leave customer oriented units, while sensitive product data like construction know-how stays within the confines of product oriented departments.

Because of the SME focus of the discussed research the integration approach was chosen. The derived research question is, how to enhance common CRM systems to enable customer product knowledge in a structured form and transfer it into product oriented (CAx) systems.

III. FEATURE BASED ENHANCED CRM SYSTEMS

Most CRM systems are based on customer data, e.g. addresses, sales opportunities, contact history and journals of visits. The journals are usually open text fields which are designed for gathering unstructured text. To analyze those data, sophisticated algorithms and methods from the text mining domain are necessary. Because of the differences in context, conceptualization, and vocabulary between salespeople on the one hand and engineers on the other, extracting and translating valuable knowledge for engineers from those fields requires considerable effort [14][15].

It is therefore preferable to enhance the *functionality* and the *data model* of CRM systems with product oriented functions and attributes directly designed for usage in development and production. Part of that task is to ensure a fit between all relevant product oriented attributes of the CRM system and the product oriented data models used in CAx systems.

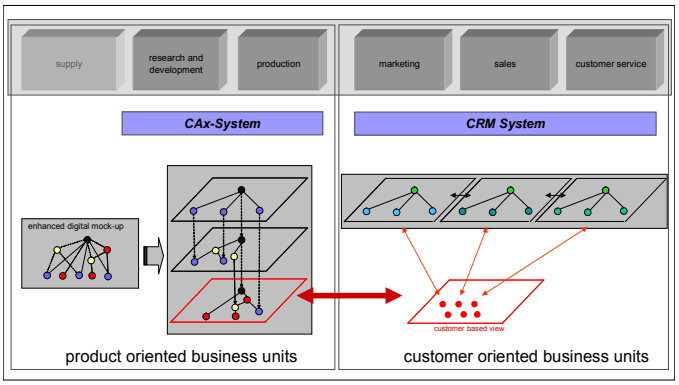

Fig. 1: Enhanced CRM data model.

A common approach applied in state-of-the-art CAx environments is the so called "feature technology". With feature technology it becomes possible to enrich geometric oriented CAx data with data objects describing the *semantics* of the depicted parts. Examples for semantic objects include material specifications, information on manufacturing processes, or material costs of a part. Semantic features can be either related to geometric features or to other semantic features. Part of the feature technology is the possibility to show different *views* of the CAx data like a "manufacturing view" or a "maintenance view". The resulting digital mock-up is the integration of all views within one compound data model [16][17][18][19].

In the case under consideration, feature based digital mock-ups with multiple views are enriched by a *customer oriented view* for the storage of additional customer oriented data (see Fig. 1). Those customer features may be linked to individual parts of the mock-up with the house of quality and can be gradually expanded with the inflow of new customer information.

Through feature mapping it is therewith possible to attach customer based information to products or separate parts. By integrating an additional component for the customer view into the CAx system, customer based features can be extracted from the digital mock-up and be added to the data model of a CRM system. The CRM is enhanced with additional data objects that represent the relevant 'customer based features'. This requires an additional add-in at the CRM system's side.

A 'customer based feature' object can e.g. contain a feature name, a feature value, an optional feature comment, a modification flag, a flag for signaling urgency, responsibility, or a timestamp. The last attribute might be utilized for the generation of a history file with feature changes. The fields of the feature object can be filled by sales, service, or marketing units staff.

For adding additional context information it is recommendable to be able to relate each feature object to other CRM objects, like customer addresses, customer events, customer sales opportunities, or customer visits.

The interface of the CRM-add-on should also allow a synchronization of new or modified customer features from the CRM system back into the CAx environment. As described, the customer based features are automatically linked by feature mapping to the corresponding product, part or feature. New customer data without an existing link to an actual part need to be linked manually either by the product manager or the construction engineer.

Therefore, the CRM add-on provides functionalities for gathering structured data, defining links to customer object classes like addresses or maintenance contracts, as well as for reporting changes in customer based features. All of this can influence counseling and sales conversations, the service quality and the complaint management in a positive way.

IV. PROTOTYPE BASED IMPLEMENTATION

To demonstrate the feasibility of realizing the enhanced CRM system, a prototype was developed. It was built upon both a standard CRM system and a standard CAD system. The selection of the systems was based on market data and requirements of SME.

On the CRM side, no system was found that included functions which were compliant with the requirements of entering structured feature data. Therefore it was necessary to adapt an existing CRM system using APIs. The selected CRM system is the standard CRM software genesisWorld® from CAS® which is based on a Microsoft SQL Server®.

On the CAx side core requirements for the implementation of the envisioned solution are:

- consequent application of feature functionality and
- an interface for import and export of digital mock-up at the side of the CAD system.

It turned out most CAD systems already comply with those demands. The product eventually chosen for the project was the CAD software Dassault Systemes Catia® V5.

The prototype contains two components:

1. The first component provides the means for reading out the digital mock-up from the Catia System and extracting customer based features. The extracted features are stored in a XML file. This component also resynchronizes the modified and new customer based features from the CRM system into the digital mock-up. To facilitate the usage this component also contains a graphical interface that visualizes the customer based view of the digital mock-up. By applying color coding this interface enables the product manager or construction engineer to get a fast overview of new, modified, and urgent features.

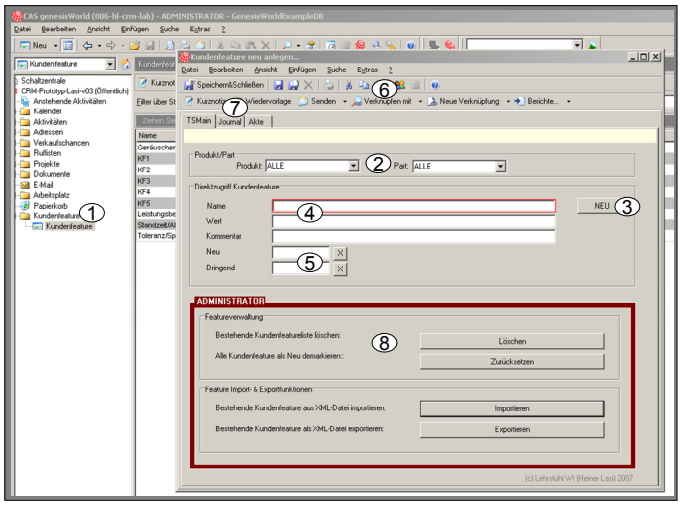

Fig. 2: User interface of the enhanced CRM system.

2. The second component of the prototype is implemented in the CRM System. An additional item in the menu opens an electronic form to edit or input customer based features (see Fig. 2, (1)). Its design closely mirrors that of other forms in the system that are used for gathering customer data. It includes fields for the input of data on product experiences and demands, functional characteristics of competitor-products, complaints and defects.

If the entered information is related to a specific product or part, those can be chosen from a structured list that is based on the feature extraction (2).

In case no customer based feature exists to cover the information, a new customer based feature (e.g. “noise development”) can be generated (3). This new customer based feature will be displayed later in the product manager view inside the CAx user interface.

With the CRM system, values of and comments on existing customer based features can be directly edited (4). There is also a possibility to mark a customer based feature as urgent, as in the example where a feature is heavily affecting a sales opportunity (5).

As pictured above the prototype allows interlinking different object classes (6). It is for example possible to link a customer based feature to a specific customer or customer group, to a sales opportunity, or to a contract.

One characteristic of the chosen CRM system is, that a history of changes is automatically stored (7). This enables all involved persons to get an overview on changes and the responsible staff members.

The administrator view contains further functionality to administrate the customer based feature items in the data base (8).

By transferring customer feature data entered in the CRM system back into the enhanced digital mock-up, the ‘customer information circle’ is closed (Fig. 3).

An example scenario that can be supported by the prototype shall illustrate its envisioned use:

A sales representative of a manufacturer of electronic semiconductors is told by a customer that a competitor offers a comparable product with faster signal processing. The sales representative enters the value "to slow for use in control of robotics" for the customer feature "response time" of the product (the parts actually affecting response times are unknown to him) and marks it as being critical. Furthermore he can associate the item with the individual customer, with the date of visit, and with further sales opportunities.

After the resynchronization with the CAD-System, all parts of the product which are possibly responsible for the response time are marked in red color (because of the criticality of the feature). Other changed customer feature values or comments are also color coded. The mapping is utilizing the automatic feature transformation as Fig. 1 shows (based on the attribution of features and parts originally entered by the engineers by applying the House of Quality).

After the engineer finishes the redesign of the relevant parts he can change the value of "response time" to uncritical. Following the next synchronization, the sales representative gets a message in his CRM environment informing him that the "response time" has been dealt with and that he should therefore talk to his customer again.

In consecutive development steps, constructing engineers or product managers find the new customer data embedded within their digital mock-up, wherever possible already matched to specific parts or features.

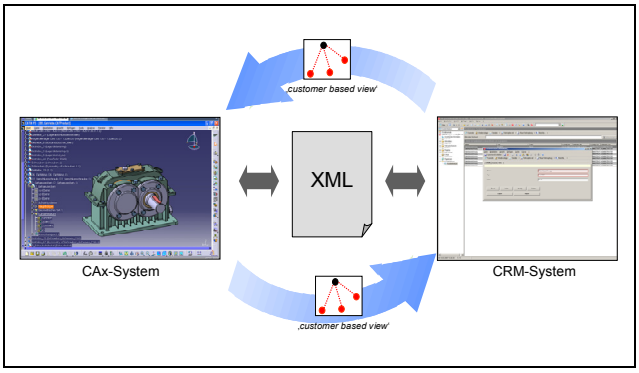

Fig. 3: Customer information cycle.

V. DISCUSSION AND CONCLUSION

This paper outlined and discussed the concept for a feature based enhanced CRM system and a prototypical implementation.

The solution aims at closing the information gap between product oriented and customer oriented business units, so that products and production processes can be enhanced with customer knowledge gathered with enhanced CRM systems. For validation purposes first feedback from industrial SMEs representatives has been gathered. The replies indicate that the solution seems to be an adequate way for tackling the lack of information exchange.

In a further step, it is envisioned to complement the solution with product and customer oriented data warehouses (DWH) as depicted in Fig. 4. This step would enable SMEs to create a production and customer oriented business intelligence infrastructure (BI) with extensive potential to optimize products, manufacturing processes and services.

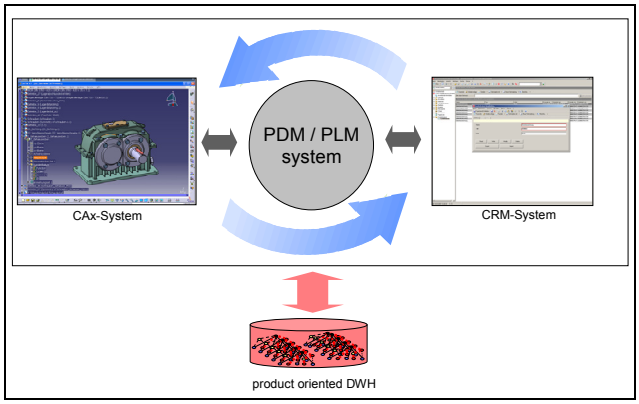

Fig. 4: Further development scenario.

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