Extending ERP Systems in SMEs into Personalized E-Commerce Applications

Petra Schubert and Uwe Leimstoll
University of Applied Sciences, Basel
Firstname.Lastname@fhbb.ch

Abstract

Personalization of E-Commerce applications is an issue that is gaining increasing importance with the advancing maturity of such systems. There is already E-Commerce software on the market offering integrated E-Shop and personalization functions. However, the available software is too time-consuming and expensive for SMEs. With this in mind we saw a need to investigate the potential for personalization from the particular angle of SMEs. This paper presents the results of a research project about personalization of E-Commerce applications run by SMEs. The project started with an empirical study about the current state of personalization in E-Commerce applications run by SMEs. The findings encouraged us to start the development of a project method for the development of standard personalization components in ERP systems. The method builds on a personalization framework which forms the basis for the requirement analysis and the consecutive extension of ERP 2 systems. Our discussion is structured around the basic steps of the customer profile life cycle: modeling customer profiles, data input, data processing, and information output.

1 Introduction

The paper presents the results of a longitudinal, publicly funded research projects about "personalization of e-commerce applications run by SMEs". The quality of E-Commerce applications has been constantly improved over the last few years. Especially the major suppliers run websites which are of noticeable usefulness and which are reliable enough to assure the customer's trust [Schubert/Dettling 2001]. This is confirmed by continuously positive growth figures in online business.

Personalization is always targeted at the fulfillment of a special requirement. It can be aimed at people as well as organizational roles in companies (e.g. a purchasing agent). Personalization in our understanding starts AFTER THE LOGIN. The mere speculation about a user on the basis of local cookies on the client PC which has the smack of spying on someone does not fall into the scope of our discussion. Personalization is context sensitive (regarding output for a

certain user) and requires learning (by the system). The interface between the customer and the system is called "point of interaction" (POI).

For the personalization of E-Shops there are integrated software packages available, such as, e.g. One-to-One (Broadvision), Dynamo Relationship Commerce Suite (Art Technology Group), Personalization Manager (Net Perceptions) or ADAPTe (ResponseLogic), which already supply the full range of E-Commerce applications. These products are expensive applications which are generally destined for use in large companies. The standardized online shops partially used in SMEs only contain rudimentary tools for the personalization of transactions.

We believe a separate consideration of these companies is meaningful because SMEs differ from corporations in many respects. In the context of the personalization of E-Commerce applications the specific features of SMEs become particularly relevant. SMEs are generally characterized by the fact that they have limited resources and compared with corporations show the benefits and drawbacks of scale. With regard to using E-Commerce applications above all limited financial resources, poor conceptual knowledge, lacking IT resources and low economies of scale can all have a negative effect. The low economies of scale result primarily from the small size of the company because the usefulness of E-Commerce applications increases with the number of transactions completed and the volume of turnover generated. In a small market segment SMEs offer specialized, qualitative high value products which are tailor-made to customers' needs (product differentiation). It is precisely for this reason that elements of personalization should also be applied in E-Commerce.

Bearing in mind the established opportunities offered by personalization at the beginning of the project we had to examine which essential technical preconditions are fulfilled in SMEs and how much demand there is for personalization. The potential of personalized E-Commerce applications in SMEs as well as the requirements for the development of a personalization tool result from these three aspects.

The paper starts with the description of the research design and a literature review on personalization. The following sections presents the findings of an empirical study. The main part of the paper is about the framework for the personalization of e-commerce applications in SMEs. We summarize the findings and draw some conclusions for the currently emerging potential for the implementation of personalization software in SMEs in Switzerland.

2 Research Design

The research findings presented in this paper stem from a project which has been carried out since 1999 together with different SMEs in the authors' home region. The reason for the start of this project was a perceived disadvantage regarding personalization possibilities in E-Business applications which are suitable for SMEs compared to the possibilities for big companies. As mentioned earlier there are software packages for personalization available on the market but those systems are too expensive for SMEs. The situation is comparable to the adoption of SAP in big companies and "light-weight ERP solutions" like Abacus in SMEs. SMEs need "easy" solutions – preferably standard software – which is cost-effective and can be customized according to the company's special purposes.

As shown in Fig. 19, the project started with an empirical survey in the region. The result encouraged the authors to proceed with the project. SMEs attribute a high value to their relationship with the customer and recognize the potential of the electronic relationship which comes with an E-Shop. On the other hand, the survey showed that the situation for the imple-

mentation of personalization (state of know-how, existing hard and software, willingness to invest, etc.) is not very favorable in most SMEs. One important result was the need for setting a focus on the further development of existing ERP systems which were already in use by SMEs (→ ERP II).

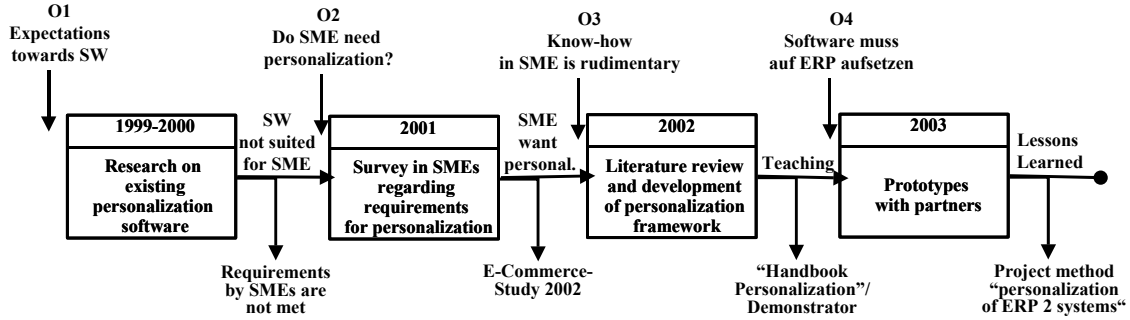

Fig. 19: Steps and results of the longitudinal research project

For the illustration of the potentials of personalization we created a "handbook personalization" which shows the possibilities from a perspective which we thought adequate for SMEs [Schubert/Leimstoll 2002]. Additionally, we built a "software demonstrator" which is publicly accessible on the Internet. It displays the possibilities in a graphical form. The following development of the personalization framework was the basis for the current development of prototypes of ERP extensions with four industry partners. The last (and still future) objective is the development of a generic project method for the introduction of personalization of E-Commerce applications on the basis of ERP II systems. Fig. 19 shows the steps of the projects with its premises (01-04) and its milestones.

3 Framework for the Personalization of E-Commerce Systems

The framework for personalization was developed as a basis for the project management (method) and the visualization of the potentials of personalization to the company owners involved in the project (teaching). The framework includes the different steps of personalization and visualizes the personalization cycle between input and output. It serves as a systematic representation.

3.1 Personalization Steps

As presented at the beginning of this chapter, the basic idea of personalization is to learn something about the customers and to use this information to tailor offers for services or information to the needs of the customer. On a technical level personalization therefore can be reduced to four simple steps:

- Step 0 – Modeling Customer Profiles (Requirements Analysis)
- Step 1 – Data Input
- Step 2 – Data Processing
- Step 3 – Information Output

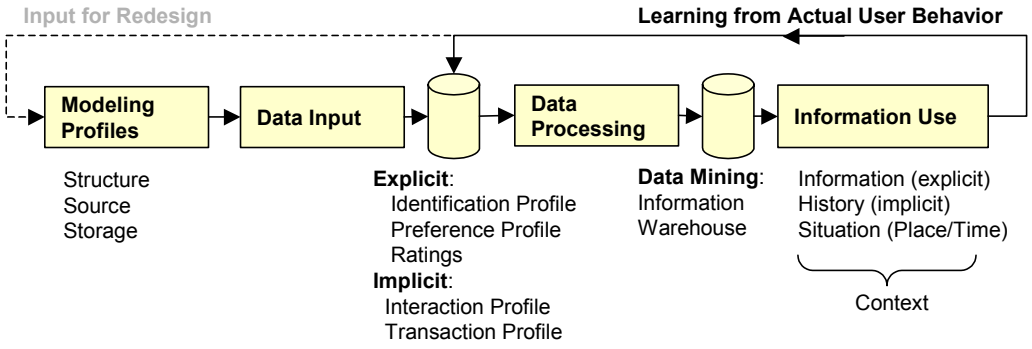

Fig. 20: Customer profile life cycle

3.1.1 Step 0 – Modeling Customer Profiles (Requirements Analysis)

The entire information about customers is usually combined in a data set called „customer profile". This data set includes all information directly requested from the customer and the information implicitly learned from Web activity. E-Commerce systems track and store compound profiles which contain parts of the profiles shown in Table 10. Depending on the personalization methods used, there are different requirements to the contents and the representation of the profile. Therefore it makes sense to think about a customer profile model before digging into issues of customer interaction.

Profile	Content
Explicit profiles	
Identification Profile	user name, role, contact information, personal browser settings, address, payment information, IP-address, etc.
Preference Profile	self-revealed preferences (product meta data)
Socio-economic Profile	self-categorization in predefined classes (age, gender, hobbies, etc.)
Ratings	three types of ratings: of products, of reviews, of pp. [scale e.g.: I like it – not for me]
Relationships	Relationships to other users/customers [e.g. "soul sisters"]
Reviews/Opinions	Plain text, images, videos and other material
Implicit profiles	
Transaction Profile	transaction log, product purchases linked to product meta data (purchases, inquiries, payment, etc.)
Interaction Profile	click stream (pp. viewed are linked to product meta data [preference categories])
External data	Information procured from other sources [e.g. weather report, local news, events, credit rating]

Table 10: Different types of profiles [following Schubert 1999]

The products in the product catalog have to be annotated using a chosen category with appropriate attributes. The annotation of products or information objects is a prerequisite to the matching of preferences with specific purchase transactions or interactions with the Web site (pp.

viewed). Fig. 21 shows the link between a preference profile, meta information, and a transaction profile. It also displays the interrelation between two types of ratings: one for products on the other for reviews written by other customers (a typical community feature).

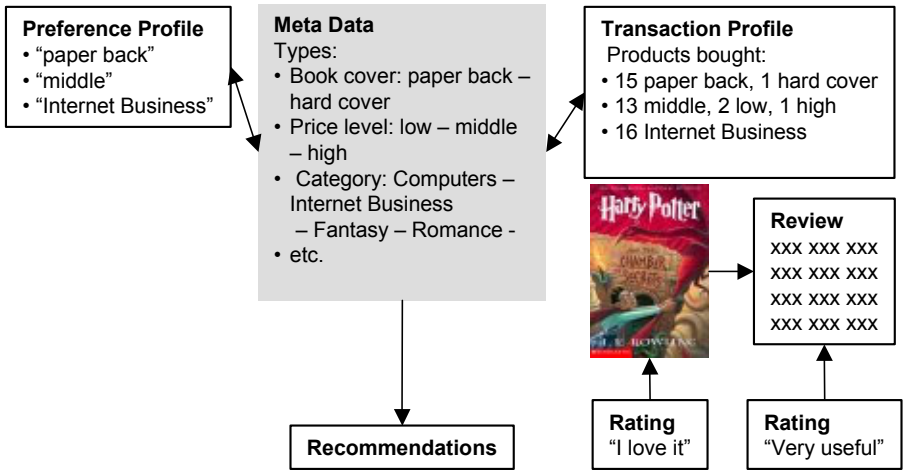

Fig. 21: Matching preference profiles and transaction profiles using meta data

Up to now, customer profile models have always been defined for one particular application of the profile models – for one particular system. In the future it will become increasingly interesting to make user profiles available for different applications in the same application area or even in different application areas. Some research work currently focuses on (organizationally and technically) separating the customer/user profile storage from the applications which are using it. This allows for the accumulation of customer information gathered in different places. This initiative represents a marketing viewpoint as e.g. taken by Microsoft Passport. It leads to an increased level of control for the customer regarding her profile [Koch/Wörndl 2001]. Some work about abstract modeling of user profiles and user profile servers can be found in [Fink/Kobsa 2000].

3.1.2 Step 1 – Data Input

The techniques for capturing customer profile information vary and require the active engagement of the customer at different degrees. We can distinguish between asking the customer (fill-in-profile, explicit feedback or ratings) and watching the customer, analyzing the data using data mining or web mining (click stream or transaction analysis).

There are different possibilities to acquire information about the interests of a user: (1) user maintains profile (explicit information input), (2) the system monitors the user in her browsing or shopping behavior and determines her interests from using information clustering techniques.

1) Explicit information input (also called "reactive approach")

On way to gather data is to explicitly ask the customer to fill in her preference profile. This can be done by selecting preferences from an ontology provided by the Web site or by explicitly rating products or information items from which the likes and dislikes can be derived. Examples for services offering personalization based on explicit information inputs are MyYahoo and the Amazon Recommendation Center.

Besides the use of explicit customer inputs for the derivation of interests this information can additionally be made available to other customers. Examples for this procedure are the acquisition and publication of explicit ratings and comments about products on the Web site.

2) Recording customer activity (also called "non-reactive approach")
Shops usually record transactions in a database. This can be done both online and offline. Large offline retail shops like Safeway, Migros or Coop have introduced membership card programs to identify customers during their purchase transactions and to keep an identified log on their transactions (e.g. Migros Cumulus card). In addition to information about transactions, online shops store information about the browsing behavior of customers. Page visits can be tracked and the time a customer spends on a particular page can be stored. The main problem with tracking the browsing behavior is the identification of the customer. Since the information about the IP address of the requesting client is often insufficient for identification due to the use of dynamic IP addresses (e.g. different proxy applications or dial-ups) current sites try to solve this problem with the help of setting local browser cookies.

Customers can even help to establish a new categorization scheme. If specific products are simultaneously bought by a number of customers one could suspect that they serve a similar purpose and that it would make sense for other clients to know about the existence of the other books when buying one of the books from this cluster. An example for this "community-enabled categorization scheme" can be found at Amazon in the section "Customers who bought this book also bought …".

3.1.3 Step 2 – Data Processing

The data collected from watching the customer (transaction or browsing histories) usually is not suitable to be used in information filtering algorithms directly. So different data mining or web mining techniques are used to cluster and filter the data. In these processes, a customer usually is classified in different stereotypes or (interest) groups. The derived information is stored in the customer profile for further processing. Data mining techniques can be applied to extrapolate trends noticed in the (large) database. This information can be used to improve and personalize the individual offer which a company presents to a client [Fischer et al. 1999]. Unfortunately, as above, it can also be used to share customer data among a community of buyers without the customer's permission.

Opportunities for personalization range from customization of the application interface to the customization of the product bundle itself. Virtually every information-based product can be tailored to the customer's needs. In addition to data mining, data processing is also about interactively learning from past interactions.

In their paper „Motivating Human-Agent Interaction: Transferring Insights from Behavioural Marketing to Interface Design" Spiekermann and Paraschiv [2002] point to the fact that personalization of user interfaces depends on the intensity of the interaction with the user interfaces. The more information about preferences is available from the user the better the computer can react. The benefit which a customer can take from an EC service depends largely on the readiness of the customer to actively provide information. If a customer provides false information, the recommendations derived from this data tend to be useless.

Spiekerman and Paraschiv investigate what motivates a user to provide data. They mainly identify the following functionalities that can lead to demotivation if they are missing:

1) Learning through user interaction ("feedback process in the profile life cycle")
2) Adaptation to the experience level of the customer ("customer literacy")
3) Recommendations from the whole set of data ("large database of interlinked profiles")

The main reason for demotivation is the missing "learning" from user interaction. Transactions that appear several times have to be simplified by features like the automatic fill-in of parameters. Examples for this are standard shopping lists for different days of the week or for different events (e.g. a raclette dinner with twelve people) as offered by Le-Shop or Migros (Swiss Internet retailers).

Such helpful features like pre-defined shopping lists are currently developing from motivational factors into must-haves in online shops. This observation was confirmed by a recent Web Assessment study. Online bookshops which do not offer the possibility for customer comments were badly rated by assessors [cf. Schubert/Dettling 2002].

3.1.4 Step 3 – Information Output

"*The whole purpose of places like Starbucks is for people with no decision-making ability whatsoever to make six decisions to buy one cup of coffee - short, tall, light, dark, caf, decaf, low-fat, nonfat etc. So people who don't know what the hell they are doing or who on earth they are can, for only $2.95 get not just a cup of coffee but an absolutely defining sense of self.*" [Tom Hanks as Joe Fox in "You've got mail"]

Not everyone wants to take one hundred decisions when buying a product as simple as a Cappuccino. In his book "Die Multioptionsgesellschaft" Gross [1994] addresses the problem of today's individuals who are confronted with too many options. In marketing, the existence of different variants of a product is usually seen as a possibility to differentiate one's own products from competitors' products. For the pragmatic customer the obligation to specify her wishes can be an obstacle. Say Peppers and Rogers [1997, 135]: "[...] but for the busy customer who wants just what he wants, choice can actually prove to be a stumbling block to purchase." Personalization based on transaction and preference profiles enables a customer specific selection from the wide range of options. The "burden of choice" is taken from the customer. Imagine a customer has already configured and bought a car, which also pleases another customer with similar taste – it is easier for the second customer to just order "the same configuration" than to run through the whole selection process again. Even if the customer wants to make some adaptations it is easier to start with the recommendation of a more or less fitting configuration than to start from scratch.

In this section we will address methods to combine customer profile information and meta information of products or information objects. The goal of matching methods is to select something for the customer based on his or her profile. In general, the selection can be about content (to be displayed), interaction (how to interact with the user) or media usage/configuration (on which channel/using which media). As already presented before, there are two general methods for selecting/matching: content based filtering and collaborative filtering. The main difference among these methods is that content based methods make use of information about the products or information objects, collaborative methods only make use of information about the relation of users to products but do not look inside products.

Content based filtering is based on annotating content objects (documents) with meta information or deriving the meta information automatically from the content of the objects themselves. A query specifies which values the meta information of matching documents should have. The comparison can be done directly, through affinity measures like vector space models or though neural networks. The shortcut of content-based methods is that the indexing (annotation with meta information) is an extra effort that has to be invested. Additionally, when using automatic measures, the results are usually not sufficient when the query is targeted at "quality" of information, e.g. for books that may please a specific user.

In contrast to content based filtering collaborative filtering tries to match users with a similar taste. Customer profiles can provide personalization functions without a specific customer having an extensive history of transactions. Based on information of like-minded people "matching" documents are recommended. The basic idea is to electronically support the principle of the "word of mouth". There are two forms, the first being interactive collaborative filtering where people interact directly (we will address this later when talking about community communication for customer support) and automatic collaborative filtering where users rate items and the system automatically calculates correlations and recommendations.

"Community knowledge comes from the accumulation of information about a whole community of customer tastes and preferences. It is the body of knowledge that a 1:1 enterprise acquires with respect to customers who have similar tastes and needs, enabling the firm actually to anticipate what an individual customer needs, even before the customer knows he needs it." [Peppers/Rogers 1997, 231]

In a brick-and-mortar setting most business customers are not aware of one another. The same applies today in basic electronic shopping environments. Clients are carriers of information that could be shared with others for the benefit of all interested parties. Uniting buyers in a virtual community of buyers, harnessing the potentials of the underlying IT-infrastructure, can help to exploit community knowledge. The technical challenge is to declare a strong semantic infrastructure for the product lines and map the semantics to the buying community, in order to achieve:

(1) accurate trapping of historical buying activity, by individual and by (implied) buying group (demographics)

(2) accurate predictive models of future buying behavior, again by individual or by the implied group, and

(3) iterative mechanisms to correct semantic weaknesses within and across product lines.

Collaborative filtering is exactly about using information provided by other customers to improve the offer for an individual customer.

Peppers and Rogers [1997] call sub-communities of customers with similar taste "affinity groups". By linking affinity groups with recorded purchase transactions of a big numbers of customers a knowledge bases emerges which can be used for the prognosis of future buying behavior of individuals. The shoe chain "The Custom Foot" uses a similar mechanism for their the shoe sales: customer rate shoes on a scale from one to five. This information is stored in large databases where customers with similar patterns are combined into affinity groups. Based on the buying behavior of the respective peer group, customers receive recommendations for future shoe purchases without even the need to look at a broad range of shoes.

Preference and transaction profiles can also support buyers regarding recurrent purchases. Once individual settings (such as preferred airplane seat, choice of menu, kind of rental car,

etc.) have been stored any future transaction can consist of only one "confirmation click" of the compiled product.

4 Developing a Standardized Project Method for Personalization Projects in SMEs

In the current project phase we are working on a project method for personalization projects with different industrial partners. The project involves four ERP solution provider who want to expand their ERP systems into ERP II systems (offering E-Business interfaces to functionality and data in the ERP system).

Each workshop follows a strict agenda. One of the project methods used is the so called “meta plan technique” were we collect ideas from company representatives and try to cluster similar ideas in joint groups. Fig. 22 shows the original result of such a brainstorming session in the form of a mind manager graphic (in German language).

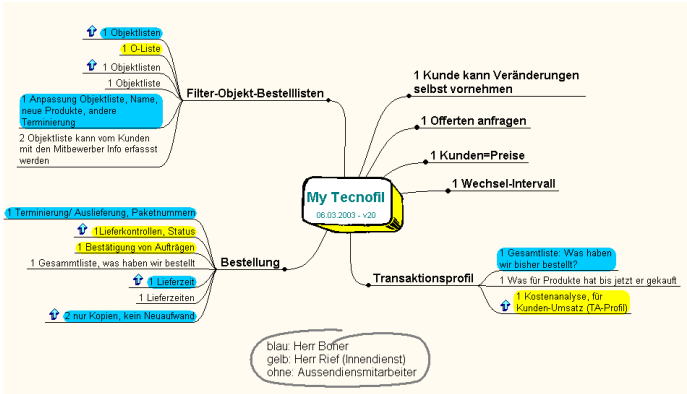

Fig. 22: An example for a meta plan result (source: company workshop)

The results of the brainstorming sessions are later aggregated and the most important objectives are identified. The personalization mechanisms are derived and priorities for implementation are set. In order to visualize the final objectives for the responsible people in the SME we developed a method for “rapid screen design”. In a subsequent workshop screens are interactively designed using the inputs of representatives of the SME, the software vendor, and the academic consultants. The screens are the template for the Web application and indicate the different stages of personalization for identified users. Fig. 23 shows an example of such a screen. The visualization helps to make sure that SME representatives and ERP vendor are talking about the same functionality of the new, extended ERP software.

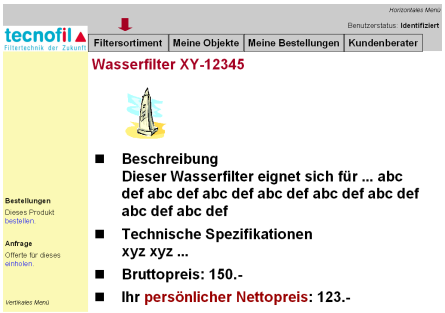

Fig. 23: An example for “rapid screen design” (source: company workshop)

5 Conclusions and Future Research

In this paper we have presented results from a longitudinal research project about personalization of E-Commerce systems. The findings of the preceding study showed that the development of personalization software is no easy undertaking. Reality shows, however, that a world of widely-differing systems is being used by internal systems (ERP) on the one hand, and by E-Commerce applications (E-Shop software) already in use on the other. The operating systems used also differ greatly. Furthermore, the majority of SMEs do not operate their own web servers, but have outsourced this task to an Internet service provider. The only possible approach is that *we involve ERP solution providers* which develop standard modules to extend their existing systems.

Our objective was to develop a specific project method for the definition of requirements for personalization of ERP-based E-Commerce solutions. The project method combines a set of useful creativity tools, elements of classical project management together with a method for rapid screen design. The most important issue is to make sure that people in SMEs and ERP vendors understand each other and manage to jointly develop a new generation of SME-suitable ERP II systems which include customizable, easy to use personalization features. Continuing with our research, we have initiated further projects with SMEs and their respective ERP vendors were we constantly apply and refine the method.

The difficulty in the development of a software lies in the fact that SMEs are today cautious about the use of such systems, and the technical preconditions are not optimal due to the wide difference in the systems employed. Nevertheless, over the next few years, substantial investments are planned in this field by many companies. All in all the, study findings have confirmed us in our assumption that a need for standardized, inexpensive personalization software for SMEs exists based on existing ERP systems, or will arise within the next few years.

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