Creating Value in E-Banking: Efficient Usage of E-Commerce Applications and Technologies

Roman Beck  
Johann Wolfgang Goethe University

Rolf Wigand  
University of Arkansas at Little Rock

Wolfgang Koenig  
Johann Wolfgang Goethe University

Follow this and additional works at: http://aisel.aisnet.org/pacis2003

Recommended Citation
http://aisel.aisnet.org/pacis2003/53

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2003 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
Creating Value in E-Banking: Efficient Usage of E-Commerce Applications and Technologies

Roman Beck\textsuperscript{a}, Rolf T. Wigand\textsuperscript{b} and Wolfgang Koenig\textsuperscript{c}

\textsuperscript{a} Institute of Information Systems, Johann Wolfgang Goethe University
Mertonstrasse 17, 60054 Frankfurt am Main, Germany
rbeck@wiwi.uni-frankfurt.de

\textsuperscript{b} Maulden-Entergy Chair and Distinguished Professor of Information Science and Management
Department of Information Science, CyberCollege, University of Arkansas at Little Rock,
2801 South University Avenue
Little Rock, AR 72204-1099, USA
rtwigand@ualr.edu

\textsuperscript{c} Institute of Information Systems, Johann Wolfgang Goethe University
Mertonstrasse 17, 60054 Frankfurt am Main, Germany
wkoenig@wiwi.uni-frankfurt.de

Abstract

Currently the finance industry is impacted by tremendous changes in its business processes. E-banking related developments such as online banking or brokerage services have reduced the importance of physical branches and changed the demands by customers on products and services. This paper analyses the differences in the finance sector in four countries based on empirical data collected via a survey. Best practice cases such as Denmark or the US in performing e-banking in an efficient way are identified by using a data envelopment analysis (DEA).–Aside from different degrees of E-Commerce diffusion differences among these four countries are observable in the strategic usage of E-Commerce. Perceived efficiency varies depending on the strategically oriented usage of E-Commerce. Leading banks in the sample have implemented deliberately and strategically a wide range of E-Commerce applications, resulting in a higher satisfaction rate, while less efficient banks are characterized by unfocused usage.

Keywords

Banking, E-Commerce, DEA, e-banking, efficiency, diffusion, financial transactions

Introduction

Finance and banking business products are mainly information goods which can easily be provided in digital form. The underlying information and communication technology (ICT)-driven processes are subject to steady changes not at least due to new distribution channels such as online banking. Changing customer preferences together with decreasing loyalty are a new challenge banks have to cope with. Internet customers are better informed and more price-sensitive than offline customers. PC and Internet usage has doubtlessly created consumer surpluses, especially with regard to online banking and brokerage services (Gordon 2000). The benefits or cost reductions of these inventions on the bank side are not as
determinable, offering multi-channel solutions with physical branches which are not substituted in the same way.

The German finance industry is heavily involved in information technology (IT) and e-commerce developments and—in terms of IT investments—an out-performer in comparison to other industry sectors. The challenges of developing and implementing a robust and durable IT architecture are of importance for sustainable growth in the future and especially e-commerce enjoys increasing importance. On the other hand, financial institutions have to cope with a number of difficulties. The IT challenges of introducing e-commerce successfully are considerable and need to be seen from an overall perspective of corporate development. E-commerce integration failures in the past lead to expensive re-organization projects, e.g., at the Deutsche Bank or Dresdner Bank in Germany.

After the Internet bubble burst German banks are looking more carefully for the return on investment in IT spending. The costly integration of new technology into an old environment has not yet shown significant efficiency or cost reduction results. Many IT projects developed into a value trap with high cash burn rates. Today, banks are focusing on small, applied projects using open standards. Also, more standardized products are introduced into the corporate environment with minimal adaptation required. The main objective is to pursue a smooth integration.

This paper provides empirical results based on a survey conducted during the summer of 2002 by IDC on behalf of the underlying research project. It analyses the implementation and usage differences in three European countries (Denmark, France and Germany), as well as the US. While German financial institutions invested heavily in the development of their IT- and E-Commerce infrastructure, it seems that the targeted efficiency gains were not realized at all. Nevertheless, IT innovation or the fast adoption of innovative techniques and technologies is a critical factor in order to be successful today and in the future. It follows that it is important to learn from best practice cases as benchmarks at the international level.

Next, this paper provides a short description of applicable innovation diffusion theories and their limitations, followed by a brief introduction into the German situation of the finance sector. Following important results of the empirical survey are presented and we conclude with a future outlook of the German finance sector development.

**Diffusion of Innovations**

The term diffusion is generally defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers 1983, p. 5). Traditional economic analysis of diffusion focuses on describing and forecasting the adoption of products in markets. In particular, the question of which factors—drivers and barriers—influence the speed and specific course of diffusion processes arises (Weiber 1993). Traditional diffusion models are based on similar assumptions: Generally, the number of new adopters in a certain period of time is modelled as the proportion of the group of market participants who have not yet adopted the innovation. Based on this fundamental structure, three different types of diffusion models are most common (Weiber 1993, Lilien & Kotler 1983, pp. 706-740, Mahajan & Peterson 1985, pp. 12-26): The exponential diffusion model (also external influence model or pure innovative model) assumes that the number of new adopters is determined by influences from outside the system, e.g., mass communication. The logistic diffusion model (also internal influence model or pure imitative model) assumes
that the decision to become a new adopter is determined solely by the positive influence of existing adopters (e.g., word of mouth). The semi-logistic diffusion model (also mixed influence model) considers both internal and external influences.

Although these theories are able to explain the process of diffusion, in general they fail in explaining the impacts of innovation on existing organization structures or the measuring of hopefully resulting efficiency improvements. Since most enterprises cannot determine their benefits by implementing innovative technologies in monetary units, the survey used here asked for the set of adopted IT and E-Commerce technologies on the one hand and the individually perceived efficiency or perceived satisfaction on the other hand.

### The German Finance Landscape

In general, German banks are so-called universal banks, offering all kinds of financial products and services. This includes credit banks (or private banks), publicly owned savings banks and cooperative credit associations. The saving and loan banks are owned by municipalities or county governments or even federal states.

The traditional distribution channel for retail banks is largely based on their physical branch networks. Germany enjoys so many branches that it may be described as “over-banked”. Although the number of domestic branch offices declined during the 1990s about 18%, Germany had still 2,695 banks with 43,834 branches in 2001 (AGB 2002). The banking density in Germany (number of inhabitants per bank branch office) has increased to around 1,880 inhabitants but is still lower than, e.g., the number of bakeries per inhabitants. In comparison to other countries in the European Union, Germany enjoys one of the most closely-meshed banking networks (AGB 2002).

The predominant majority of banks are following a multi-channel banking strategy in a more or less consistent way. Especially the small savings and loan banks do not encourage customers to use the Internet consistently where branches remain exceptionally important. A better risk communication and customer-oriented channel synchronization are possible solutions for banks to decrease costs. Current cost reduction strategies are reducing the IT budgets, accompanied by a consolidation of vendors and large numbers of layoffs.

In fact, many promising E-Commerce projects were not really successful. Micro-payment schemes were expected to become an enormous economic factor in the financial market. Smart cards and digital certificates are still important areas, but actual implementation is often premature. In traditional B2C areas, a chicken-and-egg question emerged in the market with regard to lower than expected numbers of customers and merchants. Both customers and merchants have been too reluctant to invest, resulting in even lower numbers of smart card and micro-payment customers. Maybe this technology and these applications were ahead of their time.

E-Commerce driven-banks developed more innovative products in spite of reorganizing internal operations by process innovations (Janz et al., 2001). To solve this problem, joint selling initiatives, offering standard products or product bundles (Altinkemer 2001), through existing distribution channels may help to concentrate on the core competence of banks and enables them to improve their business processes. The targeted goal is the increased separation of existing value chains. Traditional bank models involve the integration of all product processing phases. This will lead to a more efficient distribution of processing phases
inside business units with special core competences to conduct products and services in a factory-like style.

On the other hand, restricting inhibitors prevents a fast adoption of IT and e-commerce inside financial institutions. Aside from the departmentalized structure of banks and the lack of project experiences among employees, the professional tradition together with a relatively conservative behaviour slow down innovation, as well as implementation processes (Vermeulen, 2001).

An often-used way to implement innovations in the finance sector is so-called “reverse product cycle”: In the first step new software or IT equipment is implemented to support existing business processes. After the software has proven successful it is used to transform existing or create new products, services or business models (Johne et al., 2000, p. 346).

**Empirical Survey Results**

For a better understanding of the national differences between German finance institutes and banks in other countries, the underlying empirical questionnaire was designed by the research project participants. The survey itself was conducted by IDC during the period of February 18, 2002 to April 5, 2002. It was conducted in four countries with altogether 310 banks and financial institutes in Denmark (64 firms), Germany (68 firms), France (69 firms) and the United States (100 firms). The survey included only firms which used the Internet to buy, sell or support products or services.

Basically two different methods are used in general for the data analysis. For analysing the relative efficiency of E-Commerce-deploying banks, a data envelopment analysis (DEA) is used. Efficiency in this context is defined as the measured satisfaction on a five point Likert-scale, ranking from E-Commerce impact “not at all” to “a great deal” and based on the individual set of IT and E-Commerce implementations. Banks with a high satisfaction index based on the IT and E-Commerce infrastructure in place may be defined as efficient in comparison to the rest of the four country sample.

DEA (Charnes et al., 1978) can be used to compare multi-input with multi-output to analyse the efficient combinations and implementations. The object of interest in a DEA model is the decision making unit (DMU). A DMU is a flexible unit responsible for the in- and output variables. DEA compares each DMU with only the “best” DMUs of the sample. Efficient combinations of input and output relations or efficient DMUs of a sample build the so-called “efficient frontier line”. In a three-dimensional room the efficient frontier is equivalent to an imaginary cover on top of the sample, including the efficient DMUs and all theoretically possible combinations of efficient, virtual DMUs. The DEA model calculates for each DMU based on its set of inputs (in this case the number of used E-Commerce technologies [a binary vector of questions Q24A to Q24G ("Uses of the Internet")]) and set of outputs (in this case the gained benefits of E-Commerce usage—the “great deal”—by using vectors of questions Q31A to Q31J ("Impacts of doing business on-line") the relative position for each DMU. By using a linear programming procedure for the frontier analysis of inputs and outputs, DEA evaluated the “best-practice” users of E-Commerce. The basic idea of DEA is the multi-input and multi-output-oriented efficiency evaluation without any further assumptions about the structure (e.g., normal distribution) or side conditions. In contrast to parametric methods DEA can use all kinds of input and output data to analyse the production behaviour. The used DEA model was not input- nor output-oriented because neither an input minimizing (input-
oriented) nor an output-maximizing (output-oriented) analysis was necessary to evaluate the current relation identified in the survey. The model assumes furthermore variable returns of scale for each DMU depending on the size and a convex function of decreasing returns. The used software for the data analysis together with a detailed description is an academic free-ware and available with Scheel (2000).

The second method is oriented on the strategic goals of E-Commerce-using firms, as defined by Kraemer et al. (1999). According to the four-quadrant-model developed by Kraemer firms are asked about the impacts and usage of e-commerce in two different ways: The impacts on internal process optimization (operational focus) and external market penetration (market focus). In the original model Kraemer used a seven-point scale where “1” indicates “do not agree” and “7” indicates “agree completely” to measure the degree of impact of IT on the focused strategic goal. The used model in this paper is modified and uses a five-point scale. For example, if executives rated two or less on each item, they were assigned to the “unfocused” group since their responses suggested they had no discernable goal for information technology (IT). If executives rated three or above on the operational focus and two or less on the strategic market positioning, they were assigned to the “operations-focus” group. Alternatively, if executives responded two or less on the first item and three or above on the second item, they were assigned to the “market-focus” group. Finally, if executives rated three or above on both items, they were assigned to the “dual-focus” group. Based on executives’ responses to these items, firms were assigned to one of four quadrants.

Although E-Commerce technologies made their ways into European financial institutes, still remarkable differences remain. As Figure 1 indicates, Danish banks as part of the very innovative Scandinavian countries are leading in the field of online sales and procurement. 66% of Danish financial institutes reported the active usage of online sales and 77% the usage of e-procurement. At the same time, banks in larger European economies such as France or Germany use these possibilities less often. Only 49% of German banks use online sales while online procurement is only used by 40%. Trailing in both E-Commerce disciplines is France, where only 26% use online sales and 31% use online procurement.

![Figure 1. Use of online sales and procurement in the finance sector](image-url)
While the stage of the diffusion of these technologies is more or less equally far developed in European countries, US banks implement and use online procurement much more often (75%) than online sales (39%). In fact, online sales in the banking sector is primarily characterized by online banking and brokerage services which are based on an effective backbone funds transfer system with clearing centres or stock markets. While the bank transfer system in Europe is nationally standardized, in the US it is more difficult to transfer money online from a customer’s account to another account which is not at the same bank or at least certified by it. In terms of online banking and brokerage services, German banks can hardly learn from best practice cases in the US but they may learn more from the better performing banks in Denmark.

The reasons for implementing E-Commerce technologies also vary among the surveyed countries, depending on the time-lag in innovation diffusion behaviour in each country, as well as the on the different drivers and inhibitors which are also closely related to national tradition and mentality. Figure 2 depicts the yielded drivers of E-Commerce, using a five point scale, where 1 corresponds to “not a factor at all” and 5 to “a very significant factor”. While the demand of customers may be identified as an important driver in most countries, especially Denmark, the usage of online banking seems to be not yet as widespread in France on the customer side. The same holds true for online competition with major competitors. While especially in the US the adoption of E-Commerce is strongly driven by competition issues, in Denmark and again in France this factor seems to be less important in the banking sector.

![Figure 2. E-banking-related drivers in the banking sector](image-url)

One of the most unimportant drivers of E-Commerce—for economic reasons—is the necessity to be integrated in Internet-based electronic supply chains. Due to the low degree of vertical fragmentation—in general, banks develop, create and distribute their products themselves—needs of integrating suppliers are not as important as, e.g., in the manufacturing industry. But again, Denmark on the forefront ranks the highest in this field which may indicate the beginning process of using pre-configured and standardized products and services to reduce costs, as described in the introduction as one of the most important management tasks at the moment.
The cost issue or, vice versa, the return on investment orientation is therefore an important driver for banks which have left the E-Commerce trial phase at the beginning of the E-Commerce diffusion. Banks in Denmark, the US and even Germany assess the benefits of E-Commerce in the field of automation and increasing efficiency by using economy of scale effects as an important driver of E-Commerce investments. E-Commerce as enabler to expand markets, to enter new business areas or to improve the coordination with suppliers and customers may also be seen as an important driver, especially from Danish and American banks. In these areas, German and French banks rank these factors also as very important in comparison to other factors, but still below the leading nations.

The governmental contribution to the diffusion of E-Commerce seems to be rather unimportant in all surveyed countries. With the exception of France, where online business with the government seems to require E-Commerce standards, banks assess the impact of the government not as a driving reason.

Aside from the E-Commerce drivers the questionnaire investigated also the most important impeding reasons for doing business online (cf., Figure 3). Analogous to Figure 2, a five point scale was used; where 1 corresponds to “not an obstacle” and 5 to “a very significant obstacle”. Interestingly, banks in the US rated the highest obstacles on average. While the need for customer face-to-face action is not an important obstacle in Germany or France, American or Danish banks rate this obstacle as an important hindering reason. American banks, followed by French and German ones, regard security reasons as an important obstacle. While the obstacles in the field of support technologies or the bottleneck of E-Commerce skilled staff is more or less equal in the four countries, the prevalence of credit cards for online shopping is seen as an important obstacle in Germany, while other countries, at first instance Denmark, regard this factor as less important. An often mentioned obstacle is the costly integration of E-Commerce solutions in the existing IT infrastructure. US banks regard this as an important barrier; followed by Danish, German and French banks. On average, US banks believe to be confronted with more obstacles than European banks, as the average indicates.

![Figure 3. E-banking-related obstacle reasons in the banking sector](image-url)
The E-Commerce output and, therefore, the impact of E-Commerce on business processes depend directly on the intensity and variety of implemented applications. As input variables for the DEA model the results of seven questions are used, measuring the number of E-Commerce technologies in place as a binary variable. The variables are coded as 0 when an establishment uses the asked for E-Commerce technology and 1 if it does not use it. The coding is equivalent to higher spending on the input side when E-Commerce is not available or the other way round, firms using E-Commerce gain benefits by reducing their processing costs. The ten output variables of the model are measured by a five-point scale with 1 (no impact at all) to 5 (a great deal). The DEA model uses a linear program to analyse for each bank the ratio between low costs of input (using E-Commerce) and the resulting output, measured as perceived satisfaction of E-Commerce and as an impact on different processes. As a result, the DEA identifies the best practice cases or the most efficient establishments within the sample. Firms on the so-called “efficient frontier line” are relatively efficient users when compared to other firms below the frontier line. For a better explanation of the results, the average of “efficient” and “inefficient” banks is calculated. The seven input variables are aggregated to an Internet usage indicator, while the ten output variables are assembled as an average E-Commerce satisfaction index.

The DEA avails the 301 data sets as decision making units (DMU). Afterwards, the results can be used to select the efficient (marked by *) from the inefficient ones. In Figure 4 the results of the DEA are provided. On average, the efficient banks in the US use 74%, in Denmark 78% and in Germany 68% of the seven asked for E-Commerce technologies (i.e. usage of: online advertising, online sales, after sales customer service, online procurement, EDI with suppliers, EDI with customers, Internet based supply chain management). The impact on the business improvement is measured as a satisfaction index (listed subsequently in parentheses) among Denmark (2.97), Germany (3.03) and the US (3.29). Although efficient finance institutes in France are only using 43% of all available E-Commerce solutions, the resulting output is with 2.97 as high as in Denmark. Relatively inefficient banks in the sample used as expected less E-Commerce solutions, resulting in a lower satisfaction rate.

[Figure 4. Results of the DEA analyses]
The percentage of efficient banks per country, identified by the DEA method, is provided in Table 1. The results verify the data provided in Figure 1 to Figure 3, where German and French banks are also not at the forefront with regard to the usage of E-Commerce technologies. Only 14.5% of French and 23.1% of German banks are efficient users of E-Commerce, gaining nearly as much process improvement and satisfaction from these technologies as Danish or US banks. Not at least to the broad diffusion and longer history of E-Commerce in the two latter countries, these banks can gain more profit from sophisticated and mature solutions in comparison to German and French ones.

<table>
<thead>
<tr>
<th>Country</th>
<th>Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>38.3%</td>
</tr>
<tr>
<td>France</td>
<td>14.5%</td>
</tr>
<tr>
<td>Germany</td>
<td>23.1%</td>
</tr>
<tr>
<td>USA</td>
<td>41.3%</td>
</tr>
</tbody>
</table>

Table 1. Percentage of efficient banks in the sample per country

Aside from the impact on the efficiency of banks within the sample, E-Commerce may also be used to achieve and have impact on strategic goals. According to a model developed by Kraemer (Kraemer et al., 1999) firms are asked about the impact and usage of E-Commerce in two different ways: The impact on internal process optimization (operational focus) and external market penetration (market focus). The results for the efficient banks of the sample are provided in Figure 5. While 74% of Danish banks regard E-Commerce as a “great deal” for both foci, only 4% used E-Commerce technologies more or less without specific focus. Only 47% of German banks are following a dual focus when implementing E-Commerce solutions, approx. 13% of them invested strategically without focal attention.

Figure 5. The strategic orientation of financial institutions
Conclusion

In spite of the large investments in IT and E-Commerce infrastructure in the past, German banks do not yet outperform banks with longer experience in e-banking such as in Denmark or the US. Although the obstacles and drivers in the regarded countries are nearly the same, time plays an important role. The cycle to educate staff and the time to customize solutions fitting into existing IT back office systems might be too long in industries which have a diffusion time lag behind E-Commerce-leading countries such as Denmark.

Many German banks are dealing with the challenge of decentralized systems, data redundancies and non standard applications across non-integrated platforms, especially after the merger and acquisition (M&A) wave of the last decade. Forthcoming investments will have to be done in the area of intra-group and multi-channel integration. Moreover, being information-intensive organizations, with complex information systems, banks will have to continue investing in IT upgrading.

Enhancing process efficiency requires further investments in “end-to-end” automation, knowledge management and collaborative applications. The development of E-Commerce in the financial sector is a challenge for business regulation on the national and international levels. Outsourcing will continue in the areas of technological support and non-core activities.

Most financial services are based on immaterial products and services. For this reason it is important for customers that a bank signals trust, reliability and a positive image. Trust was a unique selling point of banks in the past. Since non-banks such as the automotive industry or catalogue companies have entered the market, national and international competition increased. On the other hand, globalizing markets are important for German banks in order to acquire new customers from abroad as the national market is saturated (Pilat 2001).

An additional cost-driver that must be reduced is the over-capacity in the finance sector which leads to declining prices and concentration pressure and, in turn, resulting in M&As. Gaining profits by reducing the number of branches after a merger together with the reduction of personnel is one of the observable results today across the industry.

While in the industry sector IT investments may directly improve business processes internally and externally with suppliers or customers, the banking sector can not benefit from demand side network effects accompanied with online banking and brokerage services. Banking institutions will have to increase their own installed base of online customers while at the same time reorganizing or reducing traditional distribution channels in order to gain benefits out of E-Commerce applications on the supplier side.

Acknowledgement

This research is a part of the Globalization and E-Commerce project of the Center for Research on Information Technology and Organizations (CRITO) at the University of California, Irvine. This material is based upon work supported by the National Science Foundation under Grant No. 0085852. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. This research is also supported by a grant from the German National Science Foundation (“IT-Standards and Network effects”, Grant No. 220352). We gratefully acknowledge the financial support.
References


