Preface

Although 'banking' is an old activity and has its roots in economics, finance, and commerce, the concept of 'banking technology' is of recent origin. To many people 'banking technology' means the use of computers and related hardware to streamline and automate banking operations. This book attempts to demystify 'banking technology' and offer a much broader meaning and more realistic and operationally sufficient perspective on 'banking technology'.

Universally conducting efficient banking operations and associated business involves managing:

1. The information and communication technology that drives the banks' core business.
2. Customer relationships.
3. Risks associated with conducting business with customers and other banks and financial institutions.

Therefore the book is categorized according to the three focal areas: services management, business management, and risk management.

Successful banks all over the world have invested considerably in information and communication technologies, which in turn would increase banks' profits considerably on one hand and improve the convenience and comfort levels of their customers in doing business with them on the other. Further, such banks are very sensitive to the risks they face in dealing with money in the form of credit risk or market risk or operational risk. Banks continuously embrace, with great fervor, the latest developments in information and communication technologies and customer relationship management in order to service customers better and reap more profits. If banks employ cutting-edge technologies to service their customers effectively and efficiently, regulatory requirements such as Basel II also force the banks to implement these technologies to enable uniform banking services throughout the world.

This book brings together research contributions from several academics and industrial professionals in all three aspects mentioned above, and it conveys the message that banking technology and management emerged as a new discipline in its own right over the last decade and a half.

The foreword of the book by M. Rammohan Rao, dean of the Indian School of Business, highlights the nature of the demand and supply equation that exists between the banks as service providers and the customers and the resulting explosion of research opportunities. The division of chapters into three areas is operationally sufficient.

In **Chapter I**, Ravi introduces an overview of banking technology, its various facets, and the evolution of banking. Banking technology is introduced as a consortium of several disparate disciplines such as finance and risk management, information technology, communication technology, computer science, and marketing science. The influence of all these disciplines on various aspects of modern banking operations is clearly explained. Nowadays, banks and their customers are in a win-win situation where banks offer

more and more services under one roof with impeccable reliability in a fairly secure manner resulting in more profits, and customers on the other hand can feel the pleasure and convenience of banking.

In **Chapter II**, Bellini and Pereira discuss various aspects of service quality for customers in the banking industry. They study the quality of banking services on the basis of the perception of 11,936 customers of a major Brazilian bank, and they identify five drivers that could explain customer satisfaction in an indirect way. These are: (1) business and financial transactions, (2) customer relationship, (3) information technology, (4) branch, and (5) image. They argue that these factors would help bank executives make strategic decisions in addressing a bank's customers.

In **Chapter III**, Carr reviews important theories in information systems—namely, the diffusion of innovations theory, the theory of planned behavior, and the technology acceptance model—that explain the adoption and diffusion of Internet banking. Empirical works investigating these theories are discussed. Carr also highlights the theoretical and methodological limitations of these models. Approaches that complement or challenge positivistic methodologies that are interpretive are presented in a case study. This chapter also discusses future trends in Internet banking that could include populations not included in the modern electronic financial systems.

In **Chapter IV**, Makris, Koumaras, Konstantopoulou, Konidis, and Kostakis describe the factors that affect the customer acceptance of Internet banking with the help of a case study of ALPHA Bank in Greece, which pioneered e-banking services in Greece. The authors also present a thorough analysis of the case study with the help of factor analysis on customer questionnaires in order to quantify the various variables that affect the use of an Internet banking system. They infer that although Internet banking in Greece is steadily penetrating, factors like security, ease of use, and perceived usefulness of a system continue to affect the customer's decision to adopt an Internet banking system.

In **Chapter V**, M'Chirgui and Chanel present the electronic purse as one of the latest smart card applications. This chapter explores and models the factors—economic, technological, and social—and forces driving the adoption and use of the Moneo electronic purse in the south of France. An empirical study presented analyzes the determinants of the probability of adoption for consumers and retailers, and of the frequency of use for consumers. The authors found that the frequency of use of Moneo is influenced by relative advantage, cost, visibility, security, income, and gender. Finally, the reasons why Moneo seems to have met with failure are determined, and solutions to help reach the required critical mass are proposed.

In **Chapter VI**, Patra proposes a novel hybrid service-oriented agent architecture for developing software in the banking industry as a possible solution to the growing issues of inter-and intra-bank operations. He cites the issues of interoperability, scalability, maintainability, and security as the challenges for the banking industry. He argues that the hybrid architecture can seamlessly integrate business functions across organizational boundaries. He illustrates the proposed service-oriented agent architecture with the help of a few banking applications.

In **Chapter VII**, Wonglimpiyarat, introduces a smart card (ATM/cash card, credit card, EFTPOS/debit card) application in the banking industry as a system innovation, where several parties join hands together and make it a success. The chapter elucidates the network nature of smart cards. The author argues that unless innovators in the smart card industry realize the advantages of collaboration, the diffusion of smart cards may not happen.

It is well known that Internet or electronic banking is vulnerable to cyber threats and attacks that would help the hacker or fraudster steal a customer's complete data in no time. Consequently, information assurance is of paramount importance to e-banking services. In **Chapter VIII**, Gupta, Rao, and Upadhyaya present an interesting state-of-the-art survey on the important issue of information assurance in electronic or Internet banking security. The survey highlights the critical aspects of information assurance that would be needed to design, develop, and assess an adequate electronic security infrastructure.

After Internet banking, the next big wave in e-banking includes mobile payment systems (m-payment systems) and mobile commerce (m-commerce). The paradigmatic shift from physical to virtual payment systems has been beneficial to both customers and merchants. For customers it affords ease of use. For mobile operators, mobile payment systems facilitate to consolidate their central role in the m-commerce value chain. Financial organizations view mobile payment and mobile banking as a new way of providing added convenience to their customers along with an opportunity to reduce their operating costs. **Chapter IX** by Nambiar and Lu presents all these issues along with an overview of competing mobile payment solutions that are found in the market today. It also reviews different types of mobile fraud in the m-commerce environment and solutions to prevent such fraud.

In **Chapter X**, Mantrala, Krafft, Dong, and Raman present ideas and concepts taken from marketing research literature for a successful CRM implementation in retail banking. They describe a framework for conceptualizing, operationalizing, and measuring CRM process implementation, and illustrate its use to identify activities that must be performed for successful CRM. They explain the proposed framework in the context of a case study of CRM implementation at a European bank. They also describe the importance of customer response to self-service banking technologies to CRM managers at banks. This chapter is a contribution on the operational and managerial aspects of CRM.

In **Chapter XI**, Rajagopal discusses a model that analyzes the variables associated with customer value. The model combines customer value, competitive efficiency, and profit optimization through a set of linear equations The framework is based on the theory of competitive advantage and customer lifetime value, so as to maximize the potential of the organization to create and sustain satisfied customers. The chapter also analyzes the main criteria for a successful Internet banking strategy and brings out benefits of e-**banking** from the point of view of banks, their technology, and customer values, and concludes that there is increasing returns to scale in the bank services in relation to the banking products, new technology, and customer value.

In **Chapter XII**, Narayanan presents the fundamental concepts of a data warehouse and its usefulness in banks. He argues that they are important if banks are to achieve sustainable competitive advantage against competing banks. Using data warehousing and analytics, it is possible for the banks to understand the behavior of their customers, which in turn helps them improve interaction with customers. The author argues that the same infrastructure can be used for multiple business applications.

In **Chapter XIII**, Narayanan presents the implementational details of data warehousing and analytics in the banking industry with the help of a real-life case study. Data warehousing represents one of the foremost technologies that can be used by banks to obtain sustainable competitive advantage. The author argues that adopting the right implementation methodology is important to ensure successful implementation, and he describes alternate implementation methodologies, typical challenges in implementation, and critical success factors.

While developing data warehouses for banks, an important aspect is the development of a logical data model, and the entire success of a data warehouse depends heavily on, among other things, the logical data model conceived and used. In **Chapter XIV**, Mauser describes a data model called SKO-Datenmodell, for a savings bank, Sparkassen-Organization, in Germany. The data model with 17,490 well-defined modeling objects was initially developed 15 years ago based on the financial services data model (FSDM) of IBM. SKO-Datenmodell is specially designed for Sparkassen-Organization. The different levels of SKO-Datenmodell and their uses are described in this chapter.

In **Chapter XV**, Ravi, Kumar, Srinivas, and Kasabov present an algorithm to train radial basis function neural networks (RBFNs) in a semi-online manner and demonstrate its effectiveness on bankruptcy prediction in banks. The authors employ the online, evolving clustering algorithm in the unsupervised training part of the RBFN and the ordinary least squares estimation for the supervised training part.

They compare its performance with a multi-layer perceptron, an adaptive neuro-fuzzy inference system (ANFIS), TreeNet, a support vector machine (SVM), a radial basis function neural network (RBFN), a rough set-based expert system (RSES), and an orthogonal RBFN. The authors conclude that the proposed semi-online algorithm for RBFN is better than other neural networks when area under the ROC curve (AUC) is taken as the performance metric.

In **Chapter XVI**, Yu, Wang, and Lau present a thorough literature review on the applications of neural network models to foreign exchange rates forecasting. Further, they propose a novel support vector regression (SVR)-based nonlinear ensemble forecasting model for foreign exchange rates forecasting. The ensemble comprises single neural network models as its constituent members, which are selected based on a conditional generalized variance approach. For illustration purposes, four typical foreign exchange rate series are used for testing. The authors compare several nonlinear ensemble methods for forecasting foreign exchange rates with the proposed SVR-based ensemble with respect to the measures such as normalized root mean square error and directional change statistics. Results obtained indicate that the proposed nonlinear ensemble model can improve the performance of foreign exchange rates forecasting.

In **Chapter XVII**, Samanta presents a procedure for the measurement of a value-at-risk parameter for a portfolio using historical returns. The main issue here is the estimation of suitable percentile of the underlying return distribution. When returns are normal variates, it is a very simple task. But it is well known that financial market returns seldom follow normal distribution. So, one has to identify suitable non-normal distribution for the returns and find out the percentile of the identified distribution. The class of non-normal distributions, however, is extremely wide and one has to identify the best distributional form from such a wide class. In order to handle the non-normality, he adopts a transformation-based approach originally proposed in 2003. The performance of the transformation-based VaR models is compared with two widely used VaR models. The author concludes that the transformation-based approach is a useful alternative.

The usefulness of data warehousing and data mining in banking industry is very well known. In **Chapter XVIII**, Felsövàlyi and Couran highlight the importance of data mining in risk management in lending and credit card activities at Citigroup. The authors focus attention on corporate lending based on Citigroup's own practices. They describe various aspects of risk management and assessment, early warning models, measuring loss, and also consumer lending with reference to credit cards.

In **Chapter XIX**, Bose, Pui Kan, King Tsz, Wai Ki, and Cho Hung present an overview of credit scoring models in banking and the applications of data mining in credit scoring. The applications of credit scoring presented include credit card, mortgage, and small business lending. A detailed discussion and review of the use of various data mining techniques to credit scoring are presented. A method to estimate the default probability is also presented. The chapter concludes by highlighting the merits and demerits of credit scoring.

This book is useful to the undergraduate and graduate students of an MBA program in financial engineering at any university. The book can also be used as reference book by researchers of financial engineering and banking executives.

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