Banking Operations Use Business Intelligence And Business Process Management

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Abstract--Success of banking operations is strongly correlated with the quality of customer relations and efficacy of banks processes. Banks seek means for efficient analysis of vast amount of gathered data from their IT systems. They are exploiting business intelligence (BI) technology to analyze every aspect of their data to understand behavior of their clients, striving to satisfy client's needs, in an endless race for a competitive advantage in the market. The intention of this paper is to review and discuss the most significant applications of Business Intelligence in banking as well as point to new technology trends that will affect bank's development.

Keywords --Banking, Data Warehousing, Online Analytical Processing, Data Mining, Business Process management, Business Process Intelligence

I. INTRODUCTION

The worldwide emergence of information revolution affects every type of business and industry, and particularly, the financial industry. The value of a given piece of information increases with the square root of the number of users who can access that information, multiplied by the number of business areas in which users work [12]. Despite a huge amount of information stored inside banking information systems about customers and their transactions, the banks can rarely exploit its full potential in leveraging of tactical and strategic decision making. Striving for a success, banks are trying to find means for efficient analysis of these data. Detection and suppression of fraud, risk management, customer management, product management, and loss prevention are some of the primary concerns of financial institutions. Today, as ever, financial institutions must keep their focus on key success factors, primarily on customer satisfaction and loyalty. BI technology can collect and transform millions of records for comprehensive analysis and provide tools that bankers can and should use to understand the customer behaviours, to efficiently satisfy the customer needs and fulfil customer's expectations, and, finally, to gain a competitive advantage over their competitors. Patterns in customer needs and habits are analyzed on sufficiently large sets of data. However, more the data, more difficult becomes their collection and processing into timely and relevant knowledge. If performed without adequate tools, this process often requires a lot of competence, and, ultimately, generates high costs and hardly measurable results. Implementation of BI systems in banking begins with collection, enhancement, and purification of the daily operations' data from internal and external sources, including third party organizations. Availability of "enhanced" data at low cost helps banks recognize and profit from new possibilities to strengthen customer relations, attract new prospects, and adapt to growth. BI effectively couples business strategies with information technologies leveraging on the existing IT infrastructure and skills. Returns on investment in BI systems are increased customer loyalty, segmentation of profitable customers, attraction of new customers, and increased bank's market and stock value.

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II. Business Intelligence

The BI can be defined as an ability of an enterprise to comprehend and use information in order to increase the performance [13]. BI comprises of a number of activities, procedures and applications, some of mostly used are: Data Warehousing, Data Marts, OLAP tools, tools for Extraction, Transformation, and Loading (ETL) of data, Information Portals, Data Mining, Business Modelling, etc. In this section, we briefly describe the three most commonly adopted technologies: Data Warehousing, Analytical processing, and Data Mining. The banking sector has constantly been pressed by demands for new and innovative products and by regulatory requirements. Undergoing processes of bank mergers and acquisitions happening around the globe have inevitable made bank's information systems highly heterogeneous, with disintegrated applications, overlapping sets of data, and disperse points (in location and time) of data collection and processing. To assure a timely and efficient support to decision makers in such heterogeneous and dispersed environment was nearly impossible without new technologies. The idea to collect and unify the data form disparate sources has led to the concept of Data Warehousing. Data Warehouse filled with complete and purified (cleansed and enhanced) data is a prerequisite for the task of transforming information into knowledge. On-Line Analytical Processing and Data Mining are common methods for retrieving hidden knowledge from the data stored in a Data Warehouse [15]. On-line Analytical Processing (OLAP) enable manipulation and analysis of large amount of data,

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comparison of different types of data, complex computations and, most importantly, an intuitive graphical user interface (GUI) for presentation of results in various perspectives including drill-up and drill-down capabilities. OLAP tools are essential component of today's BI systems and Information Portals. Data Mining is founded on algorithms for detection of unknown and unexpected patterns in large sets of data, clustering and segmenting of data and finding dependencies between multidimensional variables. The results of Data Mining analysis are presented graphically with the dominant and unexpected behavioural patterns enhanced. Applications for Data Warehousing, On-line Analytical Processing, and Data Mining are being widely adopted in modern banks to provide timely answers to many questions which previously required costly and lengthy programming and batch processing.

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III. Banking Operations Environment and BI technology

Financial Industry must adapt to pressures from globalization, integration, growing competition, product and market innovations, reengineering of processes, and other trends. Financial institutions must also manage risk and comply with regulatory requirements such as Basel II accord and IAS. To be successful, financial institutions must [8]:

- Monitor all aspects of client relations;
- Identify and retain the most profitable customers;
- Attract new customers from competition;
- Correctly measure products' and organizational productivity;
- Recognize new markets and needs for new Products.

To achieve these objectives, banks need to transform data of their daily transactions for complex analysis involving customer and risk management, customer relationships, customer profitability, product and channel profitability, level of customer loyalty, evaluation of marketing campaigns, efficiency of operations, market trends, and so on. Adoption of modern IT technologies is the main strategy for raising efficiency, enhancement of customer service, and profitability. To adapt to new challenges in increasingly dynamic and complex environment, banks need timely and relevant information. For this purpose, banks are accumulating vast amount of data from disparate internal and external sources such as transaction systems, third-party agencies, Web, publications, research results, etc. Problems of capturing different types of structured and unstructured data relate to normalization (determination of common metrics), filtering, grouping, cleansing, and data enhancement. Next important question is how to extract hidden knowledge from the data with issues in consistency, exactness, timeliness, and data complexity. Implementing a data warehouse and using BI technologies for knowledge discovery is a common approach to the problem. Banks, by the nature of their business, must manage risk. In the past, banks had well trained and experienced employees in charge of risk management. Novice bankers were able to learn from more experienced. Work force in modern banks is predominantly young, and more experienced and skilled bankers are either unavailable or too expensive. Information and knowledge, together with their delivering IT technologies, are becoming the main resource. Modern banker needs access to intelligent and timely information, relevant to a risk issue he or she is dealing with. Banking industry is today more oriented toward selling of new products than toward traditional services as offering loans and holding deposits [5]. That makes a modern bank's employee more a salesman than a traditional banker. Armed with timely and accurate information, the modern banker knows all about his or her customer, and all about bank's services that would be appealing for that particular customer as well as profitable and risk acceptable for the bank. BI in financial industry becomes a crucial technology in support of strategic goals of gaining a competitive advantage and securing good prospects for the future.

IV. BI Applications in Banking

A. Risk management

Risk models are typically applied in financial industry. For bank's it is important to avoid a loan default and to accurately estimate probability of default prior to issuing of a loan. Similarly, insurance companies estimate risk or probability of a claim. Credit and behavioural scoring have become useful tools to model financial problems. Beyond simply understanding customer value, the bank gains the opportunities to establish better customer relationships with increasing customer loyalty and revenue [7].Detection and prediction of fraud is very important issue because in case of credit card fraud, bank is liable for the damage. Models for prediction of credit card holder's behavior can issue an early warning of card theft and minimize bank's losses. Card theft analysis showed that number of transactions increases rapidly after the theft. By comparing expected average number or value of daily transactions, the authorization system can issue an early warning.

B. Selling of additional products to existing customers

The new mantra of marketing in banking is "the right product to the right customer at the right time" [3]. Banks try to maximize the marketing return on investment by exploiting cross-sell and up-sell opportunities because a cost of selling to an existing customer is about five times lower than cost of attracting and winning a new customer from the competition. However, prior to blind attempts to sell an additional product to existing customer it is advisable to estimate the probability of the sale's closing. Advantages of having correctly estimated probabilities are twofold: lowering the marketing campaign costs having a high response rate, and, more importantly, raising the quality of customer relations. Thus, overall profitability is raised and customer loyalty increased. Leading Croatian banks use similar models [16].

C. Reducing Churn rate

Losing a client to competition is a big problem in all industries. In saturated markets, possibilities of growth are sought through wining a new customer from competition. Clients switch to competition because of appealing offers and

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benefits. Credit card companies continually lower their interest rates to attract new customers. The lowered rates are applied during initial period of usage, with a hope that the customer, sufficiently satisfied with company's services, will continue to use products without discounted rate. Research has shown that some clients use lower rates at different card companies. BI techniques can assess a probability that client will churn or cease transactions after the discounted period. Data mining is an essential component of the customer relationship management and can be viewed and used as a descriptive and/or predictive tool. Furthermore, churn amplitude is negatively correlated with the efficiency of data mining tools [11]. It is important to identify main reasons why the customers terminate the services. The results show that for up to 80% of the terminated users of ATM, the cause of the termination is just repeatedly entered incorrect PIN. The customers stop using the network banking service or become a static account in consequence [2].

D. Client Lifetime Value

Customer lifetime value management estimates expected revenue from each customer in the future period. For example, it may be interesting to attract university students who will, eventually, become loyal and profitable customers. Bank's revenue generated on student's accounts and services may be moderate, but building a good client relationship makes good prospects for the future. A newly graduated student will soon need a car loan, a house mortgage, credit cards, a life insurance, etc. It is expected that a person with high Education has higher income and is willing to meet the expense of additional products. The BI can build models for expected client lifetime value, so that bankers can treat clients accordingly, taking into account client's profitability, not the current, but as a whole. In their work, Kim et al [9] suggest a customer evaluation and segmentation model considering the past contribution, potential value and churn probability at the same time. The three perspectives on current value, potential value, and customer loyalty assist customer segmentation with more balanced viewpoints.

E. Segmenting

Banks use traditional segmentation of clients in retail and commercial banking. Banks' products and offers are created to be appealing to various customer segments. This traditional segmentation schemes can blur a view to real client behaviours. Large amount of data about their clients banks can use for analysis of customer behavioural features. Data from socio demographic and accounting databases jointly with customer satisfaction surveys data obtained from a CRM system can be successfully mined to segment profitable customers [10]. The BI technology can detect new, previously unknown, customer segments, which can then be targeted with bank's specialized offerings. This enhances the traditional segmentation approach and augments bank's profitability. It is important to keep in mind that client data and features are changing dynamically, at least every few years. For example, a student uses fewer and different products than a married person, and yet another products after retirement.

F. Activation

Activation models estimate probability that a new customer is actually going to use a newly stipulated product or service and become profitable. For example, a client that signed a life insurance may fail to make payments. Or, a new credit cardholder doesn't use his or her new credit card. Financial products become profitable after activation, which is upon being used. There is a fraction of clients that never activate, and activation models identify such clients. Banks can then contact these clients and stimulate them to activate with special bonuses or offers, or can simply cease to provide them the service.

V. Business Process Management (BPM)

Raising efficiency, also demanded by banks' regulators, has its external limitations in terms of total number of customers that can be attracted, or revenue that can be generated on saturated and regulated financial market. Banks are thus investigating optimization of internal processes as the last frontier in battle for efficiency. First efforts in process management in banking were primarily concerned with the management of the quality of operations and are generally related to adoption of ISO quality standards and procedures to assure services with a high, consistent and predictable quality. It has been shown that quality of processes contributes to risk management, particularly to component of operational risk introduced and defined by BASEL II accord [4].

A. BP and BI

BI techniques can be used in many ways to restructure and rationalize business operations raising efficacy and lowering operating costs. We will elaborate this statement on the following examples. Process of loading of ATM's presents an organizational, logistic, and security challenge.

An ATM can be loaded with a large quantity of bills, but it would not be economically wise to load the maximum amount since average daily withdrawals may be much lower and money residing inside ATM, beside being exposed to risk of theft, does not bring interests. BI algorithms can optimize cash management by anticipating time, place, and amounts of cash to be loaded, taking into account weekly, monthly and seasonal oscillations and trends. BI tools can recommend most appropriate type of action in case of payment overdue: to wait, phone, send a notice, or initiate collection. Some banks use Data Mining to optimize bank security measures. Features of recently robbed banks are analysed, and security level of banks with similar features is raised. Modelling, deployment, and monitoring of business processes in a continuous cycle has to be supported by specialized software tools named as BP Modeler, BP Server, BP Monitor, BP Manager, and alike. Common to all tools is their graphical user interface that facilitates all stages of BP Cycle from modelling to

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deployment, and from monitoring to subsequent optimization. Software tools that integrate some or all of the above features are called BP Management System (BPMS). Advanced BPMS features include simulation of business processes in execution. This is done by assigning probabilities to business events so that near realistic simulation and verification of process design can be done before actual processes are deployed. Implementation of a BPMS means integration of human interaction with various IT systems. A process of resolving a client loan application is a typical example of BPMS implementation in banking. This process can involve human interaction, on-line web service, credit scoring application, transaction system, and BI system for measuring a client life-cycle value. During process execution, BPMS switches control from human to IT systems, possibly, a BI system for analysis of customer's previous behaviour, current services and products used, open transactions, to obtain, so called, 360o view of customer, which cannot be done by using a credit scoring application alone. To interconnect different IT systems in a common process execution task requires use of standards for exchange of data, or better, services between various IT sub-systems which are used when needed. Concept of Service Oriented Architectures (SOA) and related technologies emerge as de-facto standard for interconnection of IT subsystems. SOA proved particularly useful and applicable for implementation of BPMS [14]. As BI technology facilitates collection of data from heterogeneous and disparate sources, the SOA is suitable for interconnecting of people, processes, and various IT systems, sub-systems and their services. Modern bankers trying to leverage on residing information and past investments in IT systems to further optimize their operations are embracing SOA concept as a key technology for integration of BI, BPMS, transaction, and other IT systems

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B. Business Process Intelligence (BPI)

Once adopted, BPMS itself becomes a new data source generating vast quantities of data about bank's operational details. BPMS record many types of events that occur during process executions into process logs. The logs contain data about start and completion time of each activity, its input and output data, resources involved exceptions, etc. By cleaning and aggregating process logs into a warehouse and by analyzing them with BI technologies, we can extract knowledge about the circumstances in which high- or low-quality executions occurred in the past, and use this information to explain why they occurred as well as predict potential problems in running processes [6]. A set of tools, applications and research in area of applying BI techniques to BPMS is becoming recognized under the name Business Process Intelligence (BPI). A case study presented in [1] illustrated the practical application of process mining using three perspectives: the process, organization, and case perspective. Among other findings, this work illustrated the phenomenon that performers often do not have a good insight into the wider context of a business process. The work of Grigori et al [6] investigates process mining technologies that can be applied to analyse and predict the business metrics that business users consider significant to assess the quality of their operations.

VI. Conclusions

Data Warehouse brought the concept of knowledge discovery which bankers have quickly adopted for active support to decision making processes at all managerial levels. BI tools founded on information technologies such as on-line analytical processing and data mining make possible intelligent business decision making in complex banking environment. BI technology ideally supports advanced risk management and strategic decision-making in banks by analyzing increasingly larger volumes of data derived from growing number banking IT systems. Most benefits from BI techniques, bankers expect in enhanced customer relations, raised efficiency of marketing activities, enhanced risk management, faster response to market changes, and, ultimately, raised quality and efficacy of their processes. We show that a successful BPMS implementation requires integration with banks' BI systems and other IT systems. Banks are embracing SOA concept for integration of transactional, BI, BPMS, and other banks' IT systems. Finally, BPMS itself becomes a new generator of data that must be stored and analyzed in order to improve bank's performance. The emergence of concept of Business Process Intelligence opens new perspectives and areas for improvement of banking processes and operations. Data mining algorithms will be adapted for time-series analysis of accumulated process data logs. This new niche, that yet has to be filled, we see as the next frontier for data mining and BI applications in banking.

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