A Data Mining Framework for Performance Optimization & Business Process Redesigning

Dr. Deepak Kumar Verma[1], Dr. Jitendra K Srivastava[2], Prof. K. K. Verma[3]

Assistant Professor, Dr. Ram Manohar Lohia Avadh University, Ayodhya, India[1]

Assistant Professor, Dr. Ram Manohar Lohia Avadh University, Ayodhya, India[2]

Professor, Dr. Ram Manohar Lohia Avadh University, Ayodhya, India[3]

Abstract: Business Process Redesign (BPR) is the complete overhaul of a key business process with the objective of achieving a quantum jump in performance measures such as return on investment, cost reduction and quality of service. BPR is basically resolves the old form of organization through the improvement in order of magnitude. Professionals in the business and academics have developed a number of methodologies to support this competitive rearrangement that forms the current point of convergence, many of which have not been successful. This paper suggests the use of Data mining as a method to support the process of redesigning a business by extracting a lot of essential knowledge hidden in bulk extent of data maintained by the organization through the Data Mining models.

Keywords: Data Mining, Knowledge Management, Business Process Redesign, Business reengineering, Artificial Neural Networks.

1. INTRODUCTION

Knowledge guides us in the process of analysing data and utilizing information. Knowledge derives from information as information derives from data. Effective management of knowledge requires hybrid solutions of people and technology. Knowledge Managers in any organization need to integrate Information Systems Strategies with Business Strategies in order to attain their vision and mission. The dividend yield a victory over their competitors through connection and interaction with their environment. Therefore, performing surgery on management overhead does not need to be macheted in a dark room instead it requires transparency as suggested by Strassmann (1995). First, one must gain acceptance from those who know how to make the organization work well. Second, the organization must elicit their cooperation in telling them where the cutting will do the least damage. Third, employees must be willing to share with the organization insights about the removal of an existing business process that will improve customer service. The redesigning of an organization's processes is variously called business reengineering, business process reengineering, business process design, business redesign and so on. A useful working definition of BPR is given in Smith (1996) as the fundamental rethinking and radical redesign of an entire business – its processes, jobs, organizational structure, management systems, values and beliefs. BPR helps rethinking a process in order to enhance its performance. Academics and business practitioners have been developing methodologies to support the application of BPR principles. However, most methodologies generally lack actual guidance on deriving a process design thereby threatening the success of BPR (Selma et al, 2003). Indeed a survey has proved that 85% of BPR projects fail or experience problems (Crowe et al, 2002). Data Mining (DM) is a field that has recently attracted the attention of various researchers and organizations. According to Mena (1999) "Data Mining is the process of discovering actionable and meaningful patterns, profiles and trends by sniffing through your data using pattern recognition technologies such as neural networks, machine learning and genetic algorithms". DM tools can answer business questions that traditionally were too time consuming to resolve. They search databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectation. We begin in section 2 by defining knowledge management (KM) and specifying KM strategies. Section 3 briefly overviews Data Mining (DM) techniques as a major tool in our study. In section 4, we outline factors, importance and mistakes of BPR. Section 5 presents a framework for data mining as a technique for knowledge management in Business Process Redesign. Finally in section 6, we synthesize those expectations into a set of conclusions.

2. KNOWLEDGE MANAGEMENT(KM)

KM benefits more from map than models, more from markets than from hierarchies. Knowledge is an expensive commodity, which if managed properly is a major asset to the company. Knowledge is a complex and fluid concept. It can be either explicit or tacit in nature. Explicit knowledge can be easily articulated and transferred to others. In contrast tacit knowledge, which is personal knowledge, residing in individual's heads, is very difficult to articulate, codified and communicate(Gupta and McDaniel, 2002). Although KM has achieved a level of popularity among firms worldwide, it has no unique or standardized definition. For the purpose of this paper, we define KM as a systematic process of finding, selecting, organizing, distilling and presenting knowledge in a way that improves the organization's interest. A key objective of KM is to ensure that the right knowledge is available at the right time in a manner that enables timely decision-making (Hariharan, 2002). KM encompasses the way that organization's function, communicates, analyze

situations, come up with novel solutions to problems and develop new ways of doing business. It can also involve issues of culture, custom, values and skills as well as relationships with suppliers and customers. Wiig (1997), in his work said that organizations might pursue five different knowledge management (KM) strategies:

1. KM as business strategy
2. Intellectual asset business strategy
3. Personal knowledge asset responsibility strategy
4. Knowledge creation strategy and
5. Knowledge transfers strategy.

This paper presents business organizations with data mining techniques as an approach that supports such knowledge creation, sharing and transfer mechanisms.

3. DATA MINING TECHNIQUES

Data mining, or knowledge discovery, is the computer-assisted process of digging through and analyzing enormous sets of data and then extracting the meaning of the data. Data Mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. Most companies already collect and refine massive quantities of data. The application areas of DM as contained in recent literatures as corroborated in Jiawei (2003) include: medical treatment/disease symptoms identification, retail industry, telephone calling patterns, DNA sequences, natural disaster, web log click stream, financial data analysis, bioinformatics, melody track selection, content-based e-mail processing systems, analyzes of data from specific experiments conducted over time, analysis of nation's census database, and so on. DM techniques can be implemented rapidly on existing software and hardware platforms to enhance the value of existing information resources, and can be integrated with new products and systems as they are brought on-line. There are three groups of DM users namely, Application users, Designers and Theorists. It is usually common that the theorists based on some principal assumptions usually formulate new ideas. Therefore, some users are primarily interested in this group. The most commonly used techniques in data mining are:

1. **Artificial Neural Networks**: this is a nonlinear predictive model that learns through training and resembles biological neural networks in structure.
2. **Decision trees:** tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset.
3. **Genetic Algorithms**: They are optimization techniques that use process such as genetics combination, mutation, and natural selection in a design based on concepts of evolution. It tries to mimic the way nature works. It is an adaptive heuristic search algorithm premised on the evolutionary ideas of natural selection and genetics.
4. **Rule Induction**: the extraction of useful if-then rules from data based on statistical significance.
5. **Regression Methods**: this tries to identify the best linear pattern in order to predict the value of one characteristic we are studying in relation to another.

3.1 Data Mining Tasks

Data Mining solved various tasks are as follows:

1. **Prediction**: a task of learning a pattern from examples and using the developed model to predict future values of the target variable.
2. **Classification**: a task of finding a function that maps records into one of several discrete classes.
3. **Detection of relations**: a task of searching for the most influential independent variables for a selected target variable.
4**. Explicit modeling**: a task of finding explicit formulae describing dependencies between various variables.
5. **Clustering**: a task of identifying groups of records that are similar between themselves but different from the rest of the data.
6. **Market Basket Analysis**: processing transactional data in order to find those groups of products that are sold together well.
7. **Deviation Detection**: a task of determining the most significant changes in some key measures of data from previous or expected values.

3.2 Benefits of Dm Techniques to Web Information Management

The application of DM techniques to general business problems made possible by the increased availability of data and inexpensive storage and processing power. Also, the use of graphical interfaces has led to tools becoming available that business experts can easily use. A company or an organization embracing data mining techniques can enjoy a number of benefits; these includes understanding customers' behaviour, making a judgement on the effectiveness of the company's web site- if there is one, and benchmarking marketing campaigns (Doherty, 2000 & Mena, 1999).

3.2.1 Understanding customers' behavior

The benefits that fall under this category are summarized below:

1. Establishing the probability of customers coming back to the company or their web site.
2. Calculating the number of new customers coming to the company or their web site.
3. 3. Identify patterns relating either to navigation routes that customers follow or to what they buy.
4. Discover whom byes what and look for any cross-relationships between clients.

3.2.2 Understanding the web site's strong points

In this category, we can find the following benefits:

1. Developing a better layout of the company's web site.
2. Identifying popular and non-popular areas of the web site.
3. Personalizing online advertisement.

4. BUSINESS PROCESS REDESIGN (BPR)

Business Process Redesign is "the analysis and design of workflows and processes within and between organizations". When BPR is used carefully, it can take organizations into a new realm of competitive effectiveness. However, the redesign of individual processes will always have a limited impact unless it is implemented as part of a wider view of the organization as a whole and that wider view must take root into the corporate culture. According to Wendy (1997), this is the difference between business reengineering and process re-engineering since the first takes this wider perspective while the second is far more focused.

The purpose of this paper is to present a data mining technique that would allow business practitioners, senior managers and decision makers in organizations to extract useful, relevant, previously hidden knowledge from the organization's database which after careful management of this knowledge yields the much knowledge needed to actualize the Business Process Redesign (BPR). Ascari et al, (1995) found that certain factors are common to all BPR initiatives. Common features are:

1. The need for IT solutions tailored to fit the business
2. The focus on processes
3. The intent to use a pilot project approach
4. The need for top management commitment
5. The need for the communication of plans

The importance of other factors however, varied by whether the organization was competitively successful or was in a crisis situation. Features strongly sought by those in a competitive crisis were:

1. The need for a refocusing on the customer
2. The need to create coherent incentive programme
3. An emphasis on training
4. The redefinition of jobs
5. The need for cross-functional teams
6. The move towards empowerment

Kotter (1995) identified what he saw as the eight key mistakes that organizations engaged in BPR make. They are:

1. Not establishing a great enough sense of urgency
2. Not creating a powerful enough guiding coalition.
3. Lacking a vision.
4. Under-communicating the vision by a factor of ten.
5. Not removing obstacles to the new vision.
6. Not systematically planning for and creating short-term wins.
7. Not anchoring changes in the corporation's culture.

4.1 The BPR Framework

The idea behind a framework is to help practitioners by identifying the topics that should be considered and how these topics are related (Alter, 1999). In this perspective the framework should identify clearly all views one should consider whenever applying a BPR implementation project. For BPR, we suggest to use the framework described in figure 1. It is derived as a synthesis of the WCA (Work- Centred-Analysis) framework (Alter, 1999), the MOBILE workflow model (Jablonski and Bussler, 1996), the CIMOSA enterprise modeling views (Berrot and Vemadat, 2001) and the process description classes of (Seidmann and Sundarajan, 1997). In this framework, six elements are linked as shown in figure1.
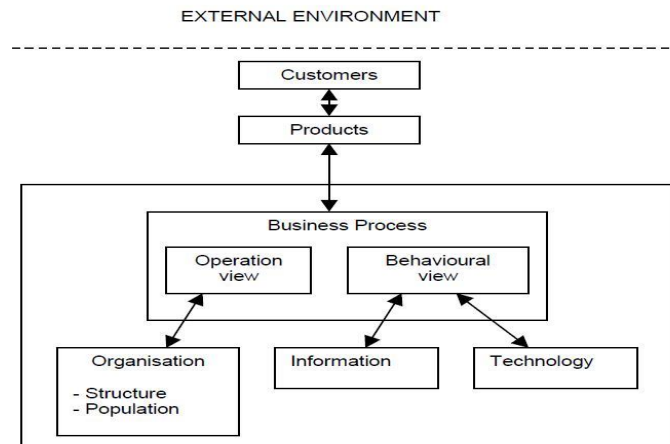
Figure 1: Framework for BPR implementation (Adapted from Selma et al, 2003)

5. THE DM/BPR FRAMEWORK

In order to achieve our purpose for this paper, it is very important to explain how the DM/BPR tool shown in figure 2 will extract and transfer the much-needed knowledge necessary for implementing the new business. Data on past business processes including vision, technology, management, sales, services, accountability and leadership is accumulated over time in a database. A clear understanding of this is required after which careful examination and analysis is carried out to organize the data in order to suit our purpose. The DM model (Algorithm) is then built which could be a neural network model, genetic algorithm model, association models, decision tree models, clustering model or regression models as the case may be. The selected model is tested on the data to yield fruitful DM results previously unknown to managers and decision makers in the organization. The top managers and decision-makers take this new knowledge and implement on the BPR framework described in figure 1 to activate the new business process.
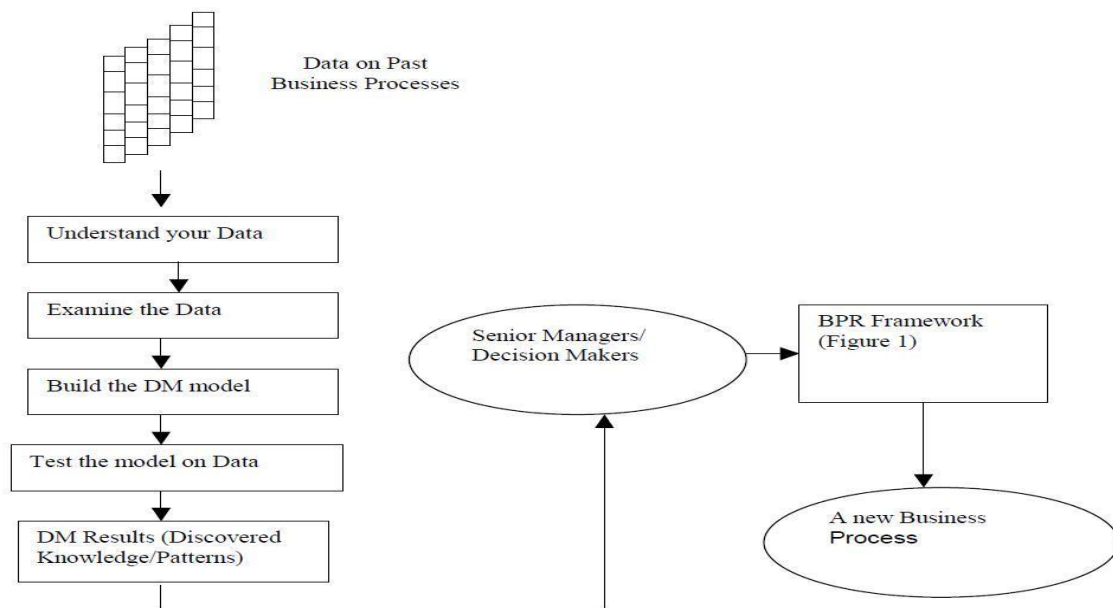

Figure 2: DM/BPR Framework

6. CONCLUSION

Data mining is a tool that is used by governments and corporations to predict and establish trends with specific purposes in mind. The process of extracting knowledge hidden from large volumes of data (DM) has proved very successful in solving many business or scientific problems to achieve competitive advantage. As suggested in the DM/BPR framework, the DM model can be deployed on the massive data collected from past business processes of the organization which then yields the much needed previously unknown knowledge and trends needed by top managers or decision makers in the organization for effective business process redesigning. The unprecedented growth of the World Wide Web coupled with the recent advances in the telecommunication networks has made possible the transmission of large amounts of data in a short period of time – resulting in the accumulation of data on the Internet. This data is stored in files specially

created for this purpose called – log files, generated by servers showing list of actions that occurred e.g. user's behaviour at a particular organization's web site. There are many data mining tools in existence to turn the raw data in the log files to useful information. Also, a customized computer program could be written to achieve a better result. If these potentials are fully and properly harnessed, decision–makers in organizations would be able to answer many questions that have been difficult to answer in time past such as: what goods should be promoted to the customer? what is the probability that a certain customer will respond to a planned promotion? can one predict the most profitable securities to buy/sell during the next trading session?, will this customer default on a loan or pay back on schedule? The proposed DM/BPR framework transforms the old business into a new prospect-oriented business organization by carefully re-engineering the old system incorporating the new discovered knowledge which helps the manager to make wise and informed business decisions in the area of accountability, business change management expertise, business process analysis, business model design, business model implementation and others.

REFERENCES

1. Alter, S. (1999) 'Information systems: a management perspective, Addison Wesley, Amsterdam.
2. Ascari, A., Rock, M. and Dutta, S. (1995) Reengineering Organisational Change, *European Management Journal*, Vol 13 No 1 pp. 1-30. Doherty P., (2000),
3. Web Mining: The e– Tailers' Holy Grail, dmDirect, [online] available at http://www.dmreview.com/editorial/dmd irect/dmdirect_articles.cfm? EdID =1891 & issue = 012800 & record = 1.
4. Gupta, A. and McDaniel, J. (2002), 'Creating competitive advantage by effectively managing knowledge management, *Journal of knowledge Management Practice*, Vol 3, No 2; pp 40-49.
5. Hariharan, A. (2002), Knowledge Management: A strategic Tool, *Journal of knowledge Management Practice*, Vol. 3; No. 3; pp 50-59
6. Jablonski, S. and Bussler, C. (1996) 'Workflow management: modeling concepts, architecture and implementation, London, International Thompson Computer Press.
7. Jiawei, H (2003) Data Mining : Current status and Research Directions ; School of Computing Science ,Simon Fraser University , March Burnaby ,
8. B.C. Canada ;August http://www.cs.sfu.ca/~han Kotter, J. (1995) 'Leading Change: Why Transformation Efforts Fail, *Harvard Business Review*, Mar-Apr; pp.59-67.
9. Mena J. (1999), 'Data Mining Your Website', dpDigital Press, ISBN: 1- 55558-222-2, The United States of America.
10. Selma, L. M., Farhi, M. and Hago A. R. (2003) 'Case-Based Reasoning as a Technique for knowledge Management in Business Process Redesign, *Electronic journal of knowledge Management, volume 1*, issue 2 113- 124
11. Wendy R. (1997), 'Strategic Management and information Systems'. An Integrated Approach: Second Edition. Financial Times Professional Limited.
12. Wiig, K. M. (September 1997) 'Knowledge management: An introduction and Perspective' *The Journal of knowledge management*, Vol 1, No 1 pp 6-14.
13. Seidmann, A. and Sundararajan, A. (1997) 'The effects of task and information asymmetry on business process redesign' International Journal of Production Economics, Vol 50, No. 213; pp 117-128.
14. Berrot, G. and Vemadat, F. (2001) 'Enterprise modeling with CIMOSA: functional and organizational aspects', Production Planning and Control, Vol. 12, No 2; pp 128-136.

BIOGRAPHY

Dr. Deepak Kumar Verma have done MCA from University of Lucknow, India in year 2011. Dr Verma has completed his Doctorate in Computer Science in the year 2016 and currently working as an Assistant Professor of Computer Science in Dr Ram Manohar Lohia Awadh University, Ayodhya, India. His research interests are Artificial Intelligence, Data Security, Data Mining and Software Engineering. He has published several research papers in refereed/reputed National and International journals & Conferences. He has 10 years of teaching experience and 6 years of Research Experience.

Dr. Jitendra Kaushal Srivastava has done M.Sc.(Electronics) from Dr Ram Manohar Lohia Avadh University, India in year 2004. Dr Srivastava has completed his Doctrate in Electronics Enngineering in the year 2011 from IIT-BHU and currently working as an Assistant Professor of Electronics in Dr Ram Manohar Lohia Awadh University, Ayodhya, India. His research interests are thick film gas sensor, thin film gas sensor, microelectronics devices, photonics and artificial intelligence. He has published several research papers in refreed/reputed National and International journals & Conferences. He has 11 years of teaching experience and 8 years of Research Experience.

Prof. K K Verma has 23 years of teaching and research experience. He is currently working as Professor in Department of Physics & Electronics of Dr Ram Manohar Lohia Awadh University, Ayodhya, India. His research interests are Experimental Material Science, Thin Film HTSC, Humidity sensor, Microstrip Antenna Simulation, Polymer Nanocomposite, VLSI designing, and Electronic Circuit Simulation. Prof Verma has published more than 50 research papers in various refereed/reputed National and International journals & Conferences.