The data mining process: At a critical crossroads in development

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Abstract This paper makes a case for the balanced management of data mining (DM). En route to making this case, the paper reviews: 1) the drivers of DM growth, ie rapid market change, falling cost of electronic data collection; 2) the pros and cons of DM, including the privacy issues; 3) the ethical framework of DM and the degree of stakeholder concerns; 4) different DM management approaches; 5) myths about DM leading to mismanagement, anatomy and shortcomings of industry DM self-regulation; and 6) benefits of balanced DM management.

INTRODUCTION

Data mining (DM) is fast becoming one of the most sought after decision-support tools with spending for hardware, software and services projected to be US\$73bn by the year 2001, up from the US\$10bn in 1998.¹ Broadly defined, DM is the efficient discovery of relevant information from large customer databases to improve corporate decision-making. When new data are uncovered from customer interfaces, they are quickly incorporated into the company's decision support system, which in turn helps managers make more informed decisions.

The forces that have contributed to the expanded use of DM process in the USA include:

— marketplace dynamics are changing at such a rapid pace, that decision-making data are quickly obsolete^{2,3}

- advances in data storage and data processing technology
- declining costs of electronic communications
- emergence of new DM products^{4,5}
- the need to be more knowledgeable about the nuances of new customers, lost customers, and retained customers⁶
- the electronic commerce revolution is not only changing business models, but also the information requirements to make timely business decisions.

Companies that are able to manage this transformation effectively 'stand to achieve substantial gains in productivity and operating efficiency, improvements in end-user and customer satisfaction — which ultimately affects the top line — and greater flexibility to respond to new business opportunities'.⁷ Companies that are not informed could be blind-sided by unforeseen market forces.

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While data miners are busy mining for customer gold, a growing number of privacy advocates are questioning current DM practices, ie the creation, use and potential sale of customer profiles in the USA.⁸

Justification for either position can be found by reviewing the wide range of DM applications. For example, cases that attest to the value of DM include:

- having mined its sales information, Wal-Mart found a link between the sale of babies' nappies and beer. No obvious link existed between the two events until an analysis showed that men were the primary purchasers. The nappies were the reason for the shopping trip and the beer purchase was an impulse buy. The net result, Wal-Mart placed nappies close to the beer, which caused beer sales to climb appreciably⁹
- Marriott's Vacation Club cut the volume of direct mail needed to produce targeted levels of response to its offers. This was achieved by blending current databases with 'enhancement' information, and then applying a predictive model to pinpoint the correct data set¹⁰
- Prudential Insurance Company combined an externally acquired demographic database on some 10 million customers with its own life, securities, real estate and credit card operational systems, which generated twice the response rate that randomly selected lists produced in the past¹¹
- American Express is building neural networks to examine hundreds of million of entries and produce a set of 'propensity to purchase scores', which are then linked to special merchant offers. American Express not only reduced their expenses, but also created more valuable information for their customers.¹²

Cases that refute the value of the DM include:

- NYNEX, a regional telephone company, which sent a mailing to its customer base encouraging them to use the company's calling cards. The problem resulted when the customers' personal identification numbers, or PINS, were visibly printed on the mailers forwarded without envelopes. Customers were upset to find out that anyone could acquire their PIN number, which was integrated with their mailing address¹³
- the American Civil Liberties Union (ACLU) is concerned that the current profiling systems in place with the government and in industry may well be infringing the privacy rights of consumers. For example, the airline industry's new computer-assisted passenger screening (CAPS) system unfairly singles out flyers of Middle Eastern descent for extra scrutiny. First Union Corporation, Charlotte, NC, raises rates and late fees for bank customers whose profiles show increasingly 'bad' behaviour — such as missing payments¹⁴
- a woman from Ohio listed her preferences for certain products in exchange for coupons and free samples, which seemed like a good idea. That is, until she began receiving obscene letters at her house from a prison inmate who knew intimate details about her life, which he acquired when the prison was hired to enter data into a customer database¹⁵
- users revolted against America On-Line in July 1997 when the company decided to sell customers' names and telephone numbers to telemarketing partners¹⁶
- gaffes involving dot.com companies such as DoubleClick, RealNetworks,

Amazon.com which demonstrated a strong interest in acquiring private consumer information, and that some firms would sell a person's speeding ticket, bounced cheque, delayed child support, and health histories to anxious buyers for as little as 90¢.¹⁷

From these cases, it is clear that: 1) the DM process is not being uniformly applied; 2) the high number of negative cases has created a major divide or gap between DM proponents and opponents; and 3) this divide can derail a company's DM programme by eroding customer goodwill, reducing marketplace feedback and weakening the company's decision-support system.

The goal of this paper is to propose a balanced management approach to administering the DM process that will close the gap between data miners and external stakeholders.

Initial discussion will be directed at the role of customer privacy, the ethical issues of DM, as well as the results of ineffectual DM practices (data mines). The paper will close by recommending a specific set of guidelines to improve the administration of the DM process.

DYNAMICS OF DATA MINING

The literature points to two DM management approaches: 1) the micro-management approach which focuses on outcomes;^{18,19} 2) macro- or balanced-management approach which focuses on exceeding the needs of all stakeholders.²⁰⁻²⁴ The foundation upon which to build a balanced management approach begins with the role of consumer privacy and related ethics issues.

THE ROLE OF CONSUMER PRIVACY

Consumer privacy is defined as 'the kind and degree of control that a person

ought to be able to exercise in respect to knowledge or the disclosure of information about himself or herself'.²⁵ Consumer privacy, which is the central issue separating DM proponents and opponents, has two dimensions of control. 'The first dimension (intrusion privacy) includes control of unwanted telephone, mail or personal intrusion and the consumer's environment, and the second (informational privacy) is concerned with the control of information about the consumer.'²⁶ Most customers have been exposed to some form of industry research, and have the ability and legal right to reject unwanted solicitations. It is, however, the second dimension — the lack of control over the creation, potential abuse, and sale of personal profiles — that has privacy advocates up in arms.²⁷

In response to consumer privacy complaints, the media and legislators are exploring current DM practices.²⁸ Recent media stories cover:

- the growing number of organisations attempting to cash in on the DM gold. For example, insurance companies built health records on nine of ten working Americans; 1,200 credit bureaus in the USA maintain files on some 170 million citizens; and 500 million credit reports are sold annually to companies all around the globe²⁹
- statements from business leaders like 'You have zero privacy ... Get over it', from Scott McNealy, CEO, Sun Microsystems, Inc.³⁰
- the reactions of the Internet Engineering Task Force (IETF), an international standards body, when its new technological concept of attaching a 'unique serial number' to every parcel of data in a computer to better track consumer behaviour was challenged. Fred Baker, IETF's

chairperson commented 'I think the privacy concerns are overrated'.³¹ This taskforce will ultimately decide whether to include the identifying numbers in the new IP addresses — Pacific Bell Telephone Company promoting its customer databases with the slogan, 'Now a business list from the company that has everyone's number'.³²

Speaking to a Senate subcommittee looking into privacy issues, Deirdre Mulligan, staff counsel noted the results of several studies that suggest, 'people want to know how the information (from data mining) is being used'.³³ Senator Robert Torricelli (D.-NJ) has also introduced legislation in the USA requiring explicit consumer consent before sites can establish 'cookies' onto the web.³⁴ Such debate could lead to a new definition of privacy rights similar to those in the European Community where companies must acquire permission before building customer profiles.³⁵ If these issues are left unattended, the gap will broaden — with privacy advocates calling for more assistance, the media continuing to report on privacy problems, and legislators seeking tighter governmental control.

THE ETHICAL ISSUES OF DATA MINING

Since research is an invasive discipline, ethics is fundamental to any discussion involving DM. Business practices like DM will be used to uncover new markets and prospects, forcing management to confront a new set of ethical issues, which they may not be prepared to handle. For example, to stay in good grace with their customers, the company may have to forego the collection of sensitive data — to the probable detriment of its decision making.

Ethics is 'an inquiry into the nature and grounds of morality'.³⁶ It deals with the study of how moral standards are applied to marketing decisions, behaviours and institutions. Data miners' close working relationships with their customers brings research into any subject under considerable scrutiny.³⁷ A *Time* survey found that '76% of consumers are "very or somewhat concerned" about the amount of personal information collected and computerized by business and the government, and 93% feel that companies that sell information should be legally required to ask permission from individuals before doing so'.³⁸ A *BusinessWeek*/Harris poll also reinforced the growing concern associated with using the Internet. The survey found a high percentage of consumers:

- (63 per cent) 'very concerned' about the receipt of unwanted information from marketers
- (71 per cent) 'very concerned' about the illegal use of credit card information
- (76 per cent) 'very concerned' about credit card information made available to other businesses without consent
- (68 per cent) 'not at all comfortable' knowing that their browsing habits and shopping patterns were linked to their real name and identity
- (82 per cent) 'not at all comfortable' with the fact that companies were creating a personal profile on them.³⁹

To administer any 'invasive' process effectively requires sensitivity to the wants and desires of all stakeholders or risk alienating their most important stakeholder — the customer. Why have data miners ignored current privacy concerns? Answers to this may be found by taking a closer look at the formation of business ethics.

THE FORMATION OF BUSINESS ETHICS

As business ethics are largely self-regulated, companies tend to employ standards to guide their decisions on subjects such as what to do about the privacy concerns of consumers. The selection of these internal standards are governed by 'whether corporations (and in particular their management who tend to define the "ethics" of the corporation) have any obligation to take the "ethical" concerns (in addition to concerns of morality and legitimacy) of various stakeholder groups into consideration in their decision-making or whether they have a free hand to guide their conduct (in matters not involving questions of morality and legitimacy) according to their own ethical norms'.⁴⁰ This choice is largely governed by a company's business philosophy which can take one of two directions. It can be market driven, 'what's right for the customer is best for the company — no matter what the price', or sales driven, 'act in your own best interest, do what is right for the company as long as it doesn't upset too many customers'.⁴¹

As the investment community presses for increased performance, however, executives are often drawn to outcomes rather than the process side of the equation, which involves the management of both higher- and lower-order needs. A similar shift from higher-order needs (ethics standards and social issues) to lower-order needs (self-preservation and physical/career wellbeing) occurred in the late 1980s during the savings and loan crisis when financial institutions chose survival needs over ethical standards.

To guard against this shift, many forward-thinking companies like Chemical Bank and Xerox have

established guidelines (codes of ethics) to help meet their social responsibilities. For the concept of social responsibility to work, the company must:

- be responsible to all stakeholders (employees, customers, and investors)
- establish a set of guidelines and ongoing training to shape employee behaviour
- take a proactive and not an obstructionist stance in the administration of those guidelines.⁴²

Applying these principles to DM, companies must broaden their personal and business standards to include the needs of all stakeholders and recognise the important linkage that exists between business philosophy and business ethics, which governs its social responsibility, and subsequently shapes the application of its business practices, like DM. The recognition of this linkage, which has gone unnoticed in the DM literature, is critical to the development of a balanced management approach versus a micro-management approach which leads to 'ineffectual DM practices' and destructive 'data mines'.

DATA MINES: THE RESULT OF INEFFECTUAL DATA MINING PRACTICES

Data mines are forces that have the power to derail a company's data mining programme. Data mines are generated by 'ineffectual data mining practices'. Once generated, data mines form a dangerous minefield that can erode customer goodwill, reduce marketplace feedback, and weaken the company's decision-support system. Figure 1 details the five most common data mines that can result from 'ineffectual DM practices'.

Figure 1 'Data Mines' caused by ineffectual data mining practices

Data mine 1: False expectations

As businesses rush to incorporate the DM process, implementers may fall prey to false expectations or myths that can erode the long-term support. Brzezinski⁴³ and Small⁴⁴ suggest that there are four data mining myths to avoid:

- *Myth*: DM will cure the company's short-term performance problems.
Reality: DM is not a quick-fix solution to an ailing business situation. Rather, it is a long-term process that offers continuous input to ongoing opportunities and problems
- *Myth*: DM is a marketing tool, and should be implemented by the marketing department. *Reality*: virtually any process can be studied, understood and improved by using the DM process. Therefore, the process should involve cross-functional team members, as departmental borders cause DM initiatives to fail
- *Myth*: DM tools automatically find customer patterns and relationships. *Reality*: even though DM software is extremely advanced, it, as all research processes, requires human intervention in the form of problem formation and direction

— *Myth*: DM tools are so sophisticated that they can replace company knowledge and experience. *Reality*: as with any forward-looking research method, one has to benchmark future projections against the realities of the past, with the final decision resting squarely on the shoulders of management.

To keep these myths from being adopted, management must: 1) understand the realities of the DM process; 2) provide support for the process to mature and contribute; and 3) set realistic performance goals along the way. Case in point: The Gartner Group, a leading consultancy in information technology, recently warned that many companies will fail to achieve the full potential of their database marketing programme by underestimating the necessary changes in technology, strategy, skill sets and cultural demands of DM.⁴⁵

Data mine 2: Process efficiency

Another problem can occur after the DM process is installed. Because DM requires cutting-edge information, old data and non-functional data must be

periodically purged from the system leading to data entry errors. To the extent that these problems persist, the accuracy and value of the information is reduced. Case in point: The Federal Trade Commission has been deluged with complaints about the inaccuracy of credit reports due to mishandled inputting. This type of mistake has led to lawsuits from people being turned down for jobs and loans due to misinformation.⁴⁶

Data mine 3: Stakeholder harmony

Two 1999 studies (Opinion Research = 86 per cent concern rate and AT&T = 87 per cent concern rate) showed that a high percentage of customers are worried about the collection, use and potential sale of personal information.⁴⁷ A separate study by Clayton/Curtis/Cottrell, a Boulder, CO marketing firm, found that more than 80 per cent of the customers surveyed felt that merchants should not be allowed to exchange consumer information with other merchants ... (of which) ... 65 per cent said they would feel violated and misrepresented if retailers sold information about them to others.⁴⁸ Case in point: the recent boycott of clothing retailers who use child labour to produce their products and the problems Intel had when top management decided that it was not necessary to recall faulty products, reinforce the strong relationship between consumers making buying decisions and the perception of the company's ethical behaviour.⁴⁹

Data mine 4: New definition of privacy rights

Even though the US Constitution does not acknowledge the 'right to privacy', the Supreme Court has found certain

privacy components do exist in the First, Fourth, Fifth, Ninth and Fourteenth Amendments.⁵⁰⁻⁵² Foxman and Kilcoyne suggest that:

'Because the government does not address privacy violations by private parties, consumers must depend on federal laws to regulate industry practices. The Fair Credit Reporting Act, passed in 1970 allows consumers to correct errors in their credit reports ... under the Electronic Fund Transfer Act of 1980, banks must notify individuals when disclosing records to third parties ... Cable and video rental companies and public libraries may not disclose choices individuals make or other personal information without consent (Cable Communications Act of 1984, Video Privacy Protection Act of 1988) ... the 1986 Electronic Communications Privacy Act prohibits telephone, telegraph, and other communications services from releasing the contents of messages they transmit.'⁵³

States have followed the lead of the federal government and expanded constitutional rights concerning consumer privacy: Case in point: over 40 states have some restriction on autodialling United States Code 1991, which addresses the time when calls are made and mandates that consent be obtained in advance. The point here is that while federal laws do not directly address information privacy protection, increased consumer pressure could, in fact, move legislators to adopt more stringent data mining laws. Governor Gary Davis of California recently signed into law SB - 926, which limits what information markets can demand from customers as a condition for signing up for discounted shopping cards. The law also bars business from selling the data they collect. This passage makes California the first state to limit what information businesses can demand from customers as a condition of signing up for discount retail cards. Whether it is at the federal

or state level, many legislators are pushing for a new definition of privacy rights similar to those in Europe.⁵⁴

Data mine 5: Self-regulating policies

Current industry attitudes suggest that many data miners are not concerned with how customers view their self-regulation, ie *Targeting Marketing's* survey produced a 15 per cent return suggesting apathy. Industry sources dismissed this finding by saying that no-one is overly concerned about privacy. For example, Robert Posch, corporate counsel for Doubleday Books & Record Clubs responded: 'Listen to Rush Limbaugh or Bob Grant or Pat Buchanan. Nobody calls in to complain about privacy or databases. This is not a big problem in the minds of consumers. It's an artificial issue in the minds of a cottage industry'.⁵⁵

Secondly, professional industry associations appear to be the only entities in the USA aggressively pursuing self-regulating 'codes of ethics'. For example the Marketing Research Association's 'Data Collection Code of Ethics':

1. The accuracy of statements given to respondents to secure cooperation.
2. The protection of respondent anonymity and need to obtain consent when anonymity cannot be secured.
3. Respect for the respondent's right to refuse cooperation.
4. The need for parental consent before interviewing children.
5. Treating respondents with respect and not attempting to influence responses.⁵⁶

Or the Society of Competitive Intelligence Professionals' 'Code of Ethics':

1. To continually strive to increase respect and recognition for the profession.
2. To pursue one's duties with zeal and diligence while maintaining the highest degree of professionalism and avoiding all unethical practices.
3. To faithfully adhere to and abide by one's company policies, objectives, and guidelines.
4. To comply with all applicable laws.
5. To accurately disclose all relevant information, including one's identity and organization, prior to all interviews.
6. To fully respect all requests for confidentiality of information.
7. To promote and encourage full compliance with these ethical standards within one's company, with third party contractors, and within the entire profession.⁵⁷

Or, again, the American Marketing Association's 'Marketing Research Code of Ethics':

1. No individual or organisation will undertake any activity which is directly or indirectly represented to be market research, but which has as its real purpose the attempted sale of merchandise or services to some or all the respondents interviewed in the course of research.
2. If a respondent has been led to believe, directly or indirectly, that he is participating in a marketing research survey and that his anonymity will be protected, his name shall not be made known to anyone outside the research organization or research department, or used for other than research purposes.⁵⁸

Thirdly, a recent Federal Trade Commission (FTC) survey found that while 90 per cent of the companies

polled collected personal information, fewer than 10 per cent followed all the established Fair Information Practices.⁵⁹ These findings suggest that self-regulating practices are not working. Case in point: Because privacy breaches can have a negative effect with customers, many marketers like IBM and Walt Disney Co. have refused to advertise on websites that do not have privacy policies. To compensate for the lack of self-regulation, several non-profit organisations, eg TRUSTe, BBBOnLine and Secure Assure have been formed to audit and approve member companies' privacy policies. As companies experience the downside of ineffectual data mining practices, many are turning to these non-profit organisations to acquire their 'Good Housekeeping' Web Site Seal of approval. In the last three years, more than 1,300 companies have joined TRUSTe alone, making its seal one of the most displayed in the country.⁶⁰

Data mines can erode customer goodwill, reduce marketplace feedback and weaken a company's decision-support systems. To disarm these data mines a more balanced approach is required to administer the DM process.

BALANCED APPROACH TO ADMINISTERING THE DM PROCESS

Data miners must decide which management approach to employ: a) the micro-mode which focuses on meeting internal stakeholder expectations, or b) the balanced mode which focuses on exceeding all stakeholder expectations. Up until recently, data miners have been able to operate in the 'a' mode due to obscurity. Recent intervention of the media has spawned DM stories which stimulated privacy advocates to seek legislation grafted around European law which forces companies to acquire customer releases before building personal

profiles.⁶¹ The most effective approach for data miners is to adopt the 'b' mode which will:

- disarm existing data mines
- restore customer goodwill
- raise the quality of the data
- improve the efficacy of the company's decision-support system
- embellish company performance.

A balanced management approach begins by considering the following guidelines:

- the DM process best aligns itself with a 'market' and not a 'sales-driven' business philosophy
- acquire a clear understanding of the DM requirements (data preparation, data processing and data analysis) by benchmarking leaders in the field before crafting goals and strategies
- establish a DM code of ethics that governs the administration of the process and addresses all stakeholder expectations
- institute an internal DM quality programme directed at ensuring that data models, values and practices are accurate, and in line with the company's goals⁶²
- develop a DM bill of rights that: a) allows customers to 'opt-out' or 'opt-in' any research programme; b) keeps customers free from any form of psychological harm, eg, stress or anxiety; c) enables customers to be informed about all aspects of the research process; and d) permits customers to acquire their personal profiles and make changes should any part be inaccurate
- police DM practices. Better yet, consider employing the use of the non-profit data mining regulators like TRUSTe, BBBOnLine or Secure Assure

- monitor the environment for new ‘data mines’. As with any advanced decision-support system, DM requires continual enhancements to maintain peak efficiency.

CONCLUSION

As companies rush to mine for data gold, data miners have to avoid adopting a micro-management approach which has been shown to erode customer goodwill, reduce marketplace feedback and weaken a company’s decision-support system. A more effective approach involves

- understanding the dynamics of the DM process
- recognising the danger of ineffectual business practices
- employing a balanced management approach when administering the DM process.

Conversely, researchers have the opportunity to formulate a universal set of DM ‘best practices’ by gathering empirical evidence on the impact of ‘data mines’ on decision making and business performance.

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