Changing the Dynamics of the Business with Analytics

by

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July 14, 2009

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Abstract

This whitepaper explores how enterprises are deploying analytics-based business intelligence (BI) to deliver insight to line of business organizations. It is based upon research on how smart enterprises are substituting business insight, information, and knowledge for high cost processes and resources. Such enterprises are building brands, reducing costs, providing improved quality of service, growing revenue, and taking market dynamics to levels of performance unimagined under previous paradigms. Based on interviews with diverse clients, this paper examines how BI is redefining the limits of what is possible in a variety of industries including retail, consumer packaged good, healthcare, healthcare, finance, and transportation. The report delves into the business insights available through real world scenarios using reporting, data warehousing, data cubing, data mining, analysis of unstructured data, and emerging trends in cloud computing to capture concrete business value. In engaging in an inquiry with line of business units, this work surfaces how firms are applying BI to capture business insight, enabling enterprises to do more with less, work smarter, and make a difference in what's possible, transforming the future of the organization, its employees, and customers.

Methodology

This paper was sponsored by IBM, but reflects the research and conclusions of the author. The author retains editorial control over the report, the design, implementation, and analysis of the client inquiries, research, and conversations. This report is based on dozens of interviews with clients who have used business intelligence analytics based on data warehousing, data cubing, data mining, analysis of unstructured data, emerging cloud computing, and related technologies. The narrative traces these BI analytics in transforming the limits of what is possible in business and attaining breakthrough business results.

This paper is a culmination of research and experience in transforming the limits of business. The author's background and experience make him distinctly qualified to undertake this inquiry into transforming business through BI analytics. His practical, hands-on experience as a database administration, data analyst, and data modeler, at a diversity of enterprise clients for Greenbrier and Russel, Inc. has guided his assessment of pragmatic outcomes. After publishing his book, *The Essential Guide to Data Warehousing* (Prentice Hall), the author engaged enterprise clients for six years as the Research Director for policy at Giga Information Group (now Forrester Research). He designed and implemented research for data warehousing, data quality, data mining, and business intelligence. Moving from Giga (Forrester), he joined IBM, where he designed, implemented, and published with several IBM colleagues, the first ever IBM Data Warehousing Satisfaction Survey.[1] During his career as an industry analyst, the author

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[1] The Data Warehouse Satisfaction Survey, Part 1: The Number One Complaint About Data Warehousing, http://www.information-management.com/specialreports/20071002/1093126-1.html

has published nearly 500 research notes and over 70 substantial reports. He has published in *Data Management Review* (now *Information Management Review*) and contributes regularly to the B-Eye-Network on topics related to business intelligence and healthcare analytics.

In instances where the clients have preferred to remain anonymous for reasons of business competitiveness, this report respects that anonymity by speaking in industry neutral terms. The author's recommendations and findings are summarized at the end.

Retailers Use Analytics to Substitute Information for Inventory

As an industry, retailing and its supply chain is being transformed from business processes that rely on individual intuition, guess work, and "tribal knowledge" to fact-based pricing, merchandising, and inventory management based on data warehousing, data mining, and related infrastructure. Those players that lack the capability for fast BI analytics of key performance indicators such as demand signals, price, and inventory are at risk of being marginalized, out sold, and left at a competitive disadvantage going forward.

Most retailers dread markdowns. Done too soon, markdowns sacrifice revenue as customers scoop up premium merchandise from the bargain table. Done too late, stores are burdened with excess inventory destined for a fire sale. In an inquiry into analytics undertaken with Dillard's, a Dallas-based purveyor of upscale, trend-right fashions, the discovery was made that, like most retailers, Dillard's was caught between the rock of sacrificing revenue and the hard place of excess inventory.

The solution? In order to obtain value from a proposed data warehousing investment, Dillard's senior executives undertook a business value assessment. This assessment identified and prioritized objectives opened up by transforming information handling through data warehousing. Areas such as merchandising, marketing, purchasing, financing, auditing, supply chain, and employee management were analyzed and queued up. "A proper readiness assessment and 'buy in' from the business function was a critical success factor in implementing the EDW," according to Melody Playford, Manager of Enterprise Systems.

With three years of sales and inventory data, the Dillard's merchandising EDW improves buying decisions and the per cent of SKUs selling at full retail price, decreasing mark downs and improving inventory management. Data mining makes possible timely and accurate, targeted promotions that were previously simply not imaginable or executable, thus redefining the limits of the possible. In an inquiry, one merchandiser reported "The EDW has revolutionized the way I do my job. With 2.6 million SKU/store combinations having lots of styles/colors, I need to identify the 10% that need to be revised. I can make hundreds of thousands of changes over night. It would have taken months to sift through all the data."

In the area of cost savings, the data warehouse improves the effectiveness of vendor negotiations by being able to inform the vendor as to what products moved and which ones did not sell. Another merchandiser reported: "The fast analysis allows Dillard's to buy out vendor stocks for top performers, beating competitors to the inventory." And again: "I can do color/style/store analysis in 2 minutes. I've been here 7 years, and this is the best thing the company has ever done!" The conclusion? The Dillard's merchandising data warehouse enabled the merchandisers to distinguish winning products from losers early on through the data mining of the information in the warehouse. In turn, this enabled the merchandisers to "corner the market" in hot items by buying out the wholesaler's inventory. This resulted in growing Dillard's revenue in a given category and leaving the competition with less to offer buyers. It also enabled marketers to optimize Dillard's previous advertising dollar, reducing promotions for losing items and those items that were in effect selling themselves and concentrating on those marginal products where promotion would make the most difference.

Dillard's saw the business value of building on the success of its IBM dynamic data warehouse. Dillard's is employing best practices, avoiding the pitfall of implementing a solution, but forgetting to design it, resulting in rework. Once again, Melody, made this statement: "In order to avoid rework, Dillard's implemented according to a plan – IBM's business value assessment (BVA) was extremely useful – we did not just implement the data warehouse, we designed and implemented and in that order."

Dillard's has succeeded in connecting with customers by presenting exciting upscale and trend-right fashions from recognized national brands and sources. Operating from 330 locations in 29 states, Dillard's fashion apparel and home furnishing success generated over $7.7 billion in revenue in 2006. Dillard's is succeeding in changing the boundaries of what is possible in retail with its data warehouse and, in particular, the actionable merchandising information derived from it. Thanks to its merchandising analytics, Dillard's has changed its way of doing business from educated guess work to informed offerings of trend setting fashions, proactively proposed to today's price sensitive shoppers. Dillard's merchandisers, marketers, and demand planners are so coordinated and reacting to emerging fashion trends so rapidly that the impact on the competition is that Dillard's appears to be everywhere at once. Dillard's no longer just follows fashions, it sets them.

In any industry that has a supply chain that moves physical products (such as retail and consumer packaged goods (CPG)), inventory optimization is a basic business issue – and opportunity. If a firm has a billion dollars in inventory, a forecasting system based on predictive analytics and exploiting three years of shipment data in a data warehouse can make a difference. If superior forecasting of shipments or sales can enable the firm to reduce inventory by 10%, the carrying costs on the $100 million dollars falls straight to the bottom line.

CPG enterprises have been unusually discrete in keeping the details of their home grown demand planning systems under wraps for years. However, an analysis of the market

dynamics for such systems and software shows that knowledge of the processes and software has gradually migrated to large-scale enterprise resource planning systems (and solutions) from SAP, Microsoft, Oracle, IBM, and some of the specialized competitors, resulting in expanding market competition for products and services.[2] This analysis finds that the critical path to success with such supply chain applications lies through a consistent, unified view of master data, especially along the product axis. For example, one CPG firm delivers three different product lines across a multi-divisional catalog – household consumables, meat products, and diverse cheese products. Aligning the three product hierarchies opens up applications that reduce inventory, enable market basket analysis, and promote cross selling. Such effort is rewarded with downstream supply chain applications that reduce costs and promote efficiency. This firm's way of doing business was changed from inefficient silos with high coordination costs to economical interoperation across virtual boundaries. Advanced applications are taking the demand plan, closing the loop back to the operational system, and actually sourcing the forecast such that it is optimized to reduce costs of time and transportation in both up- and downstream directions.

As a CPG spokesperson from a major organization states: "Half of consumers who find their preferred beverage out of stock will purchase something else. Ensuring that our customers don't run out of our products represents an enormous opportunity to capture missed sales and be there for our consumers at the moment of truth – when the product is purchased. The dynamic data warehouse helps us to insure we meet demand. When our trucks leave the distribution center, they carry not only customer orders but the best of our CPG supply chain function from initial order generation to final delivery." Wrong inventory is a double edged sword; too much inventory takes floor space and accelerates costs, too little means lost sales and usually loss of the entire market basket. Keeping the supplier and the retailer linked with information is imperative that is being met up and down the supply chain by BI analytics that are substituting efficient information for costly inventory.

Reengineering Healthcare with Analytics-Based Information Technology

Healthcare analytics is positioned to play a key role in reengineering the delivery of medical care and the operation of those enterprises that provide and pay for healthcare services. Business intelligence analytics are changing the healthcare industry by means of large experiments and small ones, some mandated by the regulatory authorities and others emerging bottom up. Healthcare analytics is enabling providers, payers, and administrators to connect the dots between high quality medical treatments, favorable healthcare outcomes, and accurate, prompt compensation for services rendered.

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[2]For example, see IBM's report: The Smarter Supply Chain of the Future: Global Chief Supply Chain Officer Study.
http://www-935.ibm.com/services/us/gbs/bus/html/gbs-csco-study.html

The headlines loudly proclaim that in the USA the healthcare systems that serve residents face more challenges than ever before – challenges around affordability, quality of care, cost of administration, and eliminating waste and fraud. Health insurance premiums continue to increase at double digit rates and healthcare now consumes over 17% of the US Gross Domestic Product, about the same as the cost of housing and the defense budget combined. The two most frequently quoted facts about healthcare in the US is that per capita spending is significantly greater than that in other developed nations and that US life expectancy and infant mortality are inferior to those of most other developed countries.[3]

The healthcare systems in the USA are poised to undergo the most significant changes they have faced since the introduction of Medicare in 1965 when information technology was just beginning to emerge. However, where the industry analyst can make a difference is in collecting examples of breakthrough applications in healthcare IT that are becoming more common, getting more attention, and attracting more resources.

There is no single silver bullet that will solve all the challenges simultaneously. However, information technology (IT) initiatives around evidence-based medicine, pay for performance, and integrated (electronic) patient records are innovations that promise significant improvements. These are transforming pharmaceutical and medical practices with knowledge generated from the integration of diverse clinical and biomedical data, ultimately leading to a more personalized paradigm of medicine. IT is positioned to make a critical difference in the success of healthcare reform and reengineering. According to Peter R. Orszag, Director of the White House Office of Management and Budget, healthcare IT heads up the list because "we can't improve what we don't measure."[4] Healthcare analytics and IT will be an essential part of healthcare reform whether it is baked in from the start or bolted on as an afterthought. Baked in is better.

For example, Convergence CT is a healthcare IT provider specializing in next generation provider practice management systems that interoperate clinical and business information to enable pay-for-performance (and related applications) that really work. CT's DB*FOCUS creates a comprehensive patient Electronic Health Record (EHR) by extracting data from existing hospital and clinic information systems whether they are integrated or not. As new patient information is added, their data elements are converged to the existing patient record seamlessly. Data can be easily analyzed via built-in query tools and users have the ability to export the data to other applications. Convergence CT uses IBM's Balanced Warehouse, a fully-integrated and scalable data warehouse appliance architecture for Linux that combines software, server, and storage resources to maximize business intelligence and information management performance for enterprises. The Balanced Warehouse chosen by Convergence CT features DB2 Data Warehouse Edition 9 technology for data compression and XML. This capability enables

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[3] *Incentives and Choices in Healthcare*, Frank A. Sloan and Hirschel Kasper, ed., Cambridge, MA: MIT Press, 2008, p. 39.
[4] "Health Costs Are the Real Deficit Threat," Peter R. Orszag, *The Wall Street Journal*, May 15, 2009, http://online.wsj.com/article/SB124234365947221489.html

clinicians, researchers and management to develop actionable knowledge quickly based on up-to-date patient-level data. In addition, IBM's Life Sciences Global Business Services Group has created a set of customized offerings for those medical practice groups whose data complexity and readiness for next generation analytics does not match the system requirements for the latest Focus*DB product.

In addition to offering healthcare providers the Patient Data Warehouse, IBM and Convergence CT market a joint solution to Life Sciences companies (Pharmaceutical, Biotech, and Medical Device firms) based on longitudinal patient data and advanced analytics. Moving forward, the two firms will continue to work together on a variety of new technologies and solution offerings.

"One of the greatest challenges facing our healthcare clients has been the lack of integrated patient data that meets today's compliance requirements," said Convergence CT, adding, "The combination of IBM's Balanced Warehouse for Linux and Convergence CT's DB*Focus provides a pre-packaged patient data warehouse solution for this highly sensitive information."

IBM and Convergence CT are implementing the joint patient data warehouse solution for the American Medical Group Association (AMGA)/Anceta National Collaborative Data Warehouse. The Collaborative Data Warehouse provides participating members of the American Medical Group Association access to HIPAA-compliant comparative healthcare data among participants of similar size and structure as well as key benchmarks for practice management, clinical performance, product performance, health outcomes, economics, efficiency, and quality of care.

The Collaborative Data Warehouse and its health informatics tools assists providers, policy makers, and purchasers (including employers and employees) in making better decisions regarding healthcare choices. This will change the business of healthcare by accurately capturing costs and medical procedures one major specialty (diabetes, cardiology, nephrology) at a time. In turn, this enables meaningful comparisons across procedural and diagnostic categories. Both payers and providers will prefer evidence-based medicine to educated guess-work, no matter how professionally based, because a single fact is worth a thousand opinions. This is being delivered as part of a ten-year contract between AMGA/Anceta and Convergence CT, which was signed in January 2006.

Meanwhile, when one looks at the amount of paperwork in the hospital, doctor's office, and outpatient clinics, it is obvious to visual inspection that basic automation and workflow can increase productivity in significant ways. As previously noted, one form of automation that has traction across providers, payers, many consumers, as well as governmental policy makers, is the electronic healthcare record (EHR). The EHR is a standards-based, secure repository for all the health-related physical exams, tests results, diagnoses, procedures, and treatments (etc.) which a patient has undergone in her or his lifetime. In effect, the EHR is an automated medical chart and portfolio that follows a

person from one medical provider to another. This vision is a work-in-progress and stake-holders in healthcare (which is just about everyone) can expect to hear more about it going forward. This is where data warehouses need to be complemented with the network effect of wide spread adoption and buy in.

Today the EHR is known in the healthcare world as being a transformational technology for reducing costs and improving clinical outcomes, benefiting patient well being. According to a *Wall Street Journal* article,[5] Intel Corp., Wal-Mart Stores Inc., and British Petroleum have data warehousing initiatives to allow consumers to coordinate their own healthcare based on an EHR. This means that a personalized version of the EHR, called a "Personal Health Record" (PER), will be available to the individual patient as a consumer of healthcare services. Along similar lines, in October 2005, IBM committed to rolling out an on-line personal health record for its US-based employees.[6]

In another example surfaced by this analysis, Geisinger Health System has been digitizing its medical records since 1997 according to widely circulated press reports (see footnotes below). In 1997 virtually no one had conceived of the digitized patient record – an early version of the EHR. Geisinger is now in a position to exploit the first mover advantage of its foundational work in EHRs to perform data mining. Mining and analyzing this information will improve treatment options and outcomes, refine best practices, genomic profiles, as well as patient preferences based on finances and life style. "Most of the world is just getting to the point where they're saying, 'We should install electronic medical record systems,'" says Ronald Paulus, MD, Geisinger's Chief Health Information Technology Officer, "We're moving up to the next level."[7] "This is an outgrowth of our commitment to health IT," said Paulus, in a separate conversation with *Health IT News*, "Geisinger has had EHRs for 10 years, but we wanted to be able to organize our data in a way that would allow us to gain more clinical insight. We didn't have the resources to develop this internally, but during discussions with IBM we recognized we shared a vision about the need to integrate real-time clinical data with historical data."[8] Internal to a hospital or medical practice, as a patient moves from one department to another, the doctors and nurses can instantly see all procedures, treatments, medications, and services being ordered, automating coordinated care in a way not possible when handwritten medical notes go into paper based archives, never to come out again, necessitating costly search and frequent rework and retesting. Today Geisinger is in a leadership position. But even leadership has its challenges. Externally Geisinger is in a position parallel to that of the owner of the first fax machine ever made. The value of

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[5] "Big Employers Plan Electronic Health Records," by Gary McWilliams, *Wall Street Journal*, November 29, 2006 page B1.

[6] https://w3.ibm.com/jct03001ps/news/w3news/top_stories/2005/10/personal_health_records.html

[7] *Information Week* IBM, Geisinger Health Deal Aims To Provide More Personalized Patient Care By Marianne Kolbasuk McGee, *InformationWeek* Oct. 10, 2006
URL: http://www.informationweek.com/story/showArticle.jhtml?articleID=193200289

[8] *Healthcare IT News*, "Geisinger and IBM collaborate on new IT infrastructure" by Richard Pizzi, Associate Editor 10/13/06
http://www.healthcareitnews.com/story.cms?id=5723 [URL checked on March 14, 2007]

the fax function grows explosively as more and more people acquire and use them. As additional payers, providers, employers, and consumers come on stream, the probability is that the value of Geisinger's investments will be increasingly rewarded by the market.

Healthcare analytics is also on the critical path to enabling a practical approach to pay for performance (p-for-p) by connecting the dots between the underlying data warehousing technology and the mission of bringing breakthrough pay for performance results to practice groups and healthcare providers. While the experts are divided on the effectiveness of p-for-p, the goal is to link healthcare provider compensation to measures of quality or outcome. This is distinct from the historically prevailing payment model of fee-for-service, which critics have argued drives excessive usage of healthcare services. What each of these innovations has in common is an analytic layer devoted to abstracting lessons learned from basic underlying clinical dimensions.

While p-for-p signifies many different things to different stake-holders, it is still a work-in-progress. P-for-p will become a lightening rod for diverse experiments with the data that flows from clinical practices and the costs associated with those practices. When p-for-p works right, it means identifying and reducing the cause of variations in care and the price of care. This is just following best practices because p-for-p builds in an incentive for cost control.[9] It can do this best when a defined benchmark has been laid down against which performance and cost can be compared going forward. It does *not* mean requiring a primary care physician who is already seeing 24 patients a day to see 32 going forward.

Pay for performance collects, stores, secures, aggregates, anonymizes, and literally converges – meaningfully merges – clinical and financial data for process optimization and analysis. Furthermore, a method (algorithm) is required to re-identify patients from the anonymized version of data if permission is given to identify and use them in clinical trials that test drugs, medical devices, and new procedures. Convergence CT has such an algorithm and implements it well, protecting the patient from inadvertent disclosure while retaining the ability to notify the patient of outcomes. Also, for those medical practice groups whose data complexity and readiness for analytics is incomplete, whether due to obsolete systems or legacy practices, providers will require data integration services prior to implementing a full blown p-for-p system. Information and evidence-based medicine will change the healthcare industry by rewarding coordination of care for complex and overlapping disease entities such as diabetes, chronic heart failure, emphysema, and other diseases of aging, a practice that is less well compensated today in comparison with more highly technical specialties such as laparoscopic surgery.

As the population ages, geriatric care is becoming the focus of teams of physicians and healthcare providers. For such a focus to be meaningful and succeed across over-lapping medical specialties and silos reinforced by fee-for-service payment paradigms, a consistent unified view of the patient is critical path for treating and managing

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[9] *Incentives and Choices in Healthcare*, Frank A. Sloan and Hirschel Kasper, ed., Cambridge, MA: MIT Press, 2008, p. 295-7.

interacting, overlapping chronic conditions and diseases. The accuracy and timeliness of the information is essential and gives new urgency to the promise of "trusted information" where even a single life is at stake.

Managed care – not in the sense of excluding and rejecting treatments – but in the sense of coordinating the treatment of multiple diseases simultaneously – is made workable and more efficient between teams of doctors thanks to information technology such as unified and consistent EHRs and the seamless interoperation of underlying healthcare systems. The latter, of course, is a work-in-progress and expected to remain so for the next three to five years.

Ultimately, however, the net result will be that payers, providers, and administrators will work smarter and more cost effectively in delivering healthcare services to those in need through data warehousing based analytics, data mining, and information based-medicine and do so while improving the already high quality of America's world class health system. The on-going implementation of information based healthcare is improving the efficiency of service delivery, clinical outcomes, and patient-centeredness by connecting the dots between the quality of service, favorable medical outcomes, and accurate compensation. More accurate, efficient, and timely payment processes are reducing costs for payers (ultimately, all of us) and incenting providers to improve quality.

Finally, in the area of healthcare reengineering, a new trend - cloud computing is on the horizon. Healthcare payers – especially the Blue Cross insurance firms - were among the first historically to employ electronic data interchange (EDI) through proprietary wide area communication networks in the 1980s. Fast forward nearly thirty years and a half a dozen IT revolutions later, the idea is still a powerful method of attaining efficiencies in workflow and transaction processing. Enter now the high concept of a healthcare computing cloud.[10] The healthcare computing clouds provides virtual network and computational resources linking providers with providers as well as payers and the consumers of healthcare. The "virtualization of resources" is the key feature of the cloud, enabling on demand computing to expand to meet peak demand or contract to reduce costs during slack periods. With the proper security protocols, largely in the form of encrypted data transfer, the development of a set of standards (including HL7) for the communication of patient medical information between authorized providers and providers and payers enables workflow process and efficiencies. Examples of diagnostic imaging such as X-rays and CAT scans are occasionally being interpreted by physicians in India, such practices are still the exception and likely to remain so due to international privacy regulations. The state of the art still amounts to handing the patient a large manila envelope containing the hardcopy images and having him or her walk it over to the office of the physician with whom the next consultation is scheduled (or inefficiently and expensively send it by snail mail). Fast forward three years, and the X-ray or MRI technician will press a button and transmit the information from one system to another through a secure, standards-based computing cloud and do so routinely. Of course, the

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[10] See "Data Warehousing in the Clouds: Making Sense of the Cloud Computing Market," October 9 2008, http://www.b-eye-network.com/view/8702

existing Internet is likely to provide the basic structure on top of which additional virtualization, virtual private network, and special purpose medical practice application programming interface (API) will ride. For the time being, this is mostly a vision. But it makes sense for the regulatory authorities to prime the pump in terms of standards setting, research grants, and demonstration projects. Watch for it at a healthcare enterprise near you soon.

Financial Services Finds Needles of Gold Amid the Haystack of Transactions

Business intelligence analytics are transforming financial services by making sure that the call center associate is ready with a timely up sell offer when the customer calls; by enabling the firm to relate to the customer as a source of life time value instead of in the past as an isolated, standalone account; and, in an emerging specialty market about which we will say more shortly, performing data mining against reams of detailed transactions to realize micro increments of revenue that add up to big dollars.

The challenge for many financial institutions, even in the best of times, is to see the forest for the trees. Financial institutions – banks, brokerages, payment card companies, collection agencies – often first meet customers as multiple accounts, including those through acquisitions that do not necessarily have an obvious connection. Data warehousing has been the wedge through which customer master data has transformed the financial services from account- to customer-centric thinking and delivery.

Data warehouses that concentrate on the product dimension of master data (e.g., SKUs in retail or overdraft protection in banking) end up delivering services in supply chain management; whereas, in contrast, those that focus on the customer dimension often emphasize marketing services, cross selling, up-selling based on life-time value, and market basket analysis. A bold statement of the obvious is that customers are the key to financial service success. A customer-oriented dynamic data warehouse is the key to providing customers with superior service and, thus, the financial service enterprise with superior returns from building win-win relationships with customers.

Business insight is being captured in financial services through the analysis of customer information. The calculation of customer life-time value requires aggregating a significant volume of transactions – in effect, a life-time of transactions or, at least, a strong sample of life-time and life-style financial interactions. In particular, the business intelligence analytics enables the financial services firm to leverage the business value that shows up across what might otherwise be diverse, functional silos. In good times and in less good times, financial service firms are using business analytics to shift from being product driven to being customer-centric, building a consistent, unified view of the client to whom a variety of products and services can be delivered using cross selling and up selling based on a market basket analysis.

The business result? What these financial services businesses all have in common is information. When all is said and done, information is the key product and information is really the only product. The profile of the client's buying behavior provides a map for promotions, cross selling, and establishing loyal and long-term customer relationships in an effective network of commercial exchanges. Some 20% of banking cusomters provide 120% of the bank's profit. How do you identify these people? Is it the ones with the largest portfolio? Sometimes not. Large customers negotiate smaller fees that squeeze the profit margin. Experience shows that the most accurate way to identify these high margin individuals, regardless of total net worth, is through the calculation of lifetime value. However, such a calculation requires the aggregation of a lifetime of transactions (or more precisely a representative sample of such a set). Such an aggregation is one reason that the data warehouse was invented. That means a data warehouse, capturing, aggregating, and evaluating the relevant customer profile.

The results of the effort to grow the customer relationship based on a customer-oriented dynamic data warehouse are starting to show in the financial services firms reviewed in this inquiry. The shifts in the global financial markets allow the firm to focus on plans to align balance sheets and business operations with core asset – clients. These actions position the enterprises for continued future growth and improved quality earnings. Information is changing financial services by enabling firms to obtain a consistent, unified view of the customer across multiple accounts, providing the opportunity to make a cross sell and up sell offer to the customer at the "moment of truth," when she or he is on the phone with the call center representative or even visiting the web site.

Meanwhile, there is an interesting trend that is just starting to appear on the radar above the horizon. An emerging specialty area of financial services – collecting debts from those who have over-extended themselves financially (e.g., using credit cards) – has gotten a boost. The analysis of unstructured texts such as those stored in call center files of client-collector interactions shows the way to improving collection yield results while simultaneously reducing the costs associated with collecting overdue debts. The unstructured, free form text reports of conversations are made based on the call center operator field notes. When parsed for standard abbreviations – e.g., "hg" for "hung up" – and aggregated by client, these notes can map to defined outcomes in the collection life cycle. While the following example may seem obvious, what is not obvious is that the accounts receivable department (or collection agency) cannot possibility know the debtor's employment status (and, hence, financial) without aggregating volumes of call center textual notes. Such text mining is now feasible and being applied by leading enterprises in the collection business. For example, if an individual has held a steady job for years but is temporarily out of work due to illness or misfortune, then the person should be put on a deferred payment plan. In contrast, if another person has never had a job, and, in an extreme example, is in prison, then the attempt to obtain payment is so much additional effort wasted and the debt should be written off. No further cost will be incurred chasing such a bad debt. The point is that the status of the potential payer is not obvious until the call center notes are standardized, parsed, and analyzed. Then and only

then can the would-be collector move beyond guess-work and be given the appropriate script to optimize total debt recovery.

It seems as though accounts receivable is a growth industry, and this is in large part due to the innovations at a closely held cost containment and accounts receivable management enterprise (that prefers to remain anonymous). Business processes (B2B) around insurance payments, telecommunication long distance interchange, as well as traditional debt collection from consumers (B2C) have become so complex that duplicate payments, under- or over-payments, and other material inaccuracies occur more often than anyone might have expected, though, of course, the vast majority of transactions are accurate. These "golden needles" are hidden in the haystack of volumes of data; and, until now, just represented a cost of doing business to insurers, healthcare providers, telecommunication carriers, and payment card financers. No longer. This innovative firm has pioneered automated methods of going after these hidden errors in a variety of business verticals such as telecommunications, healthcare, insurance, and payment cards.

What do all these accounts receivable, cost containment, and collection processes have in common? Large volumes of data combined with complex processes, policies, and the requirements for fast response and turn around to many simultaneous users of the system. Now the competitive differentiator has shifted to the ability to perform sustained real time update. The warehouse is dynamically updated by ETL, message brokers, and concurrent SQL. More detail is useful, so let's consider another example.

For example, in telecommunications, aggregation is not just useful, it is essential. There are so many billions of calls being exchanged every month – and sometimes every day – that it is administratively and financially impractical to worry about a penny for any given call. However, in aggregate, bundles of calls add up to tens of thousands of dollars per period. Therefore, the ability to track and update aggregates is on the critical path to success in reconciling large volumes of bundled calls along with the ability to decompose the aggregate down to the individual level for auditing purposes if necessary. Data mining the haystack of billions of transactions for these golden needles is a winning proposition for high performance analytics. This enables the telecomm firm to recapture lost profits that the enterprise did not even know existed through enhanced reconciliation of "call hand offs" between diverse telecomm carriers down to the detailed item.

There are three approaches to innovative accounts receivable management that are enabled by analytics. The yield is business insight. First, the analytic application performs a computationally intense audit of transactions to surface transactions that are suspect, probably representing duplicate transactions or over-payments. The client can then manage the collection process itself. This is a business innovation in analytics redefining the limits of what is possible – it is actually upstream from accounts receivable, since it is money owed that the client firm did not know it had coming. Second, the analytic process can advise the client on the debt collection process itself, depending on where the debtor stands in the collection life cycle. Third, it can actually go after the debt itself. However, the real business innovation consists in surfacing

collectable debt, accounts receivables, where there apparently was none before. The calculation must be precise because the revenue was overlooked in the first place due to imprecise reporting off the call log; but once identified the revenue opportunity is crystal clear.

Collection applications occur in a variety of industries, but are discussed here since they are primarily about business revenue and finance. The details of claims adjudication and payments in health insurance provides opportunities for account payable (payer) optimization. In order to surface such non-obvious, hidden debt, a computationally intense process of comparing significant volumes of transactional data across time is required. Sometimes duplicates health claims are obvious, based on patient date of birth and date of service, and other times it is necessary to understand the actual medical procedures, based on policies. Scanning detailed data is useful; but it is necessary to understand the meaning of the data, the semantics, based on a data model and policies and procedures. In effect, reverse adjudication is needed to get the tougher cases. For example, routine allergy shots are usually not accompanied by in-office procedures to treat dangerously high blood pressure. Such an anomalous combination of procedures could indicate a clerical error – or fraud. It is flagged for follow up investigation.

This innovative business model in accounts payable (and receivable) has attracted some large competitors such as McKesson and GE (which purchased IDX Systems). You can do what it is doing with large numbers of human auditors, but the greatest returns are for those who understand the process, know what to look for, and master how to automate based on policy-based analysis of large volumes of data. That's it. That's how this innovator turns denials into dollars for its clients.

The use of data mining software to create predictive models, scoring the probability that a transaction is an overpayment or other non-obvious error, relies on the availability of a data warehouse of clean, consistent transactional data. The key is not only being able to build a predictive model, but to implement the model in such a way that it can evaluate volumes of transactional data in the data warehouse and do so in a timely way.

Travel Uses Analytics to Counter Strong Head Winds

Business intelligence analytics in the travel and hospitality industry is enabling transportation carriers to "get inside the heads" of prospective travelers through one of the "stickiest" relationships in the business – the airline frequent flier program – to correlate the right offer to the customer with his or her "moment of truth" - when the individual is ready to buy. At the same time, business intelligence analytics is being applied to operational processes such as fuel purchasing, using historical price points to hedge fuel prices, smoothing out volatility and even realizing a profit when the market breaks just right.

Given strong heads winds caused by a 33% rise in fuel costs over the summer of 2008, airlines are looking to work smarter as well as harder. According to the examples

surfaced by research and analysis, one way of doing this is through the use of analytics and business intelligence based on the dynamic data warehouse.

In the transportation business, just as important as managing the terabytes of data generated by line of business operations, is the need for speed. Customer insight and service as well as operational efficiencies in the planning needed to manage the fleet, seats, and routes is rapidly moving in the direction of near real time responsiveness from the data warehousing system.

Thus, it makes perfect sense that one of the most successful projects this carrier enabled through the data warehouse was fuel optimization. This carrier developed a fuel forecasting system to plan and optimize jet fuel purchasing and delivery. In addition to serious number crunching, storing three years of "experience data" with pricing trends (mostly upward with near-term downticks) and a similar amount of experience data on seasonal demand made this a classic demand planning exercise. While fuel costs have generally been upward, they are not uniformly so. Seasonal variations provide opportunities for smart trading and buying in such a way as to reduce or manage costs over against simply being at the effect of the latest market bump. The result? A saving of some $200 million a year in fuel costs for the entire fleet.

The IBM Data Warehousing Satisfaction Survey was developed to show the top applications supported by data warehousing, across any platform, indicates they are still finance, marketing, and sales.[11] The situation is similar at most major airline carriers. Based on detailed transaction data stored in the data warehouse, a revenue analysis function looked at attrition, booking class buy downs, walk up fares, free tickets, and displacement. The idea was to optimize the mix of each in order to maximize revenue. For example, it is well know that seats on airplanes are a "perishable" commodity. When a plane pushes back from the gate, an empty seat generates no revenue and yet costs fuel. Therefore, it may make sense to adjust the price in such a way as to increase the likelihood of the seat being filled. But this does not just mean dropping the price, since you do not want to condition travelers to wait until the last minute. Last minute travelers generally pay more. Once again the experience data is an important input into what is a complex operations research problem. Such pricing optimization is estimated to generate incremental revenue of some $80 million a year. When demand for a seat rises, so does the price, and visa versa; so waiting until the last minute many not prove optimal from the perspective of the buyer.

A similar initiative at one carrier over the summer, targeting domestic flights, implementing a series of pricing and inventory modifications improved financial results by $6 million a month. Such yield management has become a best practice transferred from one industry to another and applied to a variety of time-sensitive, perishable products such as hotel rooms, cabins on cruise ships, car rentals, and even round trips on trucks returning from delivering freight.

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[11] See "The Bounds of Data Warehousing are Limited only by the Business Imagination," DMReview.com, http://www.dmreview.com/specialreports/20071009/1093127-1.html

Tragically, more than one major airline carrier was caught up in the multiple negatives following the September 11, 2001 terrorist attacks. The data warehouse was used to provide passenger information to law enforcement authorities under authorized subpoenas in order to identify the hijackers. As rising fuel costs and plummeting passenger counts forced a part of the industry to seek bankruptcy protection, the data warehouse was instrumental in financial forecasting in the turn around as this firm emerged from Chapter 11. The data warehouse enabled the troubled carriers to optimize routes, equipment (airplanes), pilots, and support staff to accommodate a shrunken market with more limited demand. Such right sizing was not a trivial exercise, but was completed in near record time, albeit under extreme economic and contract negotiating pressure.

On a happier note, a carrier spokesperson reported:, "Data warehousing is on the critical path of our loyalty program. It enables us to know who is flying when and where and how best to serve our loyal, frequent fliers with a timely promotion or upgrade, making the friendly skies even more inviting. The frequent flier relationship is one of the "stickiest" known to business, since upgrade benefits are highly valued by most fliers. It really does keep 'em coming back. Now we are extending analytics in the direction of operational business intelligence." Ticketed travelers are able to print their boarding pass from home before leaving for the airport, reducing congestion at airport kiosks and facilitating passenger flow through security.

As part of the ongoing continuous improvement efforts, this airline carrier is improving processes and driving efficiencies that will enhance service to customers and reduce costs. According to research, savings is coming from improvements in major processes such as flight planning (to reduce navigation fees) and smaller processes such as the consolidation of technology around yield (seating) management. In addition, the company will streamline operations and corporate functions to further reduce overhead spending for salaried and management personnel. These functions are increasingly automated and justified by the use of the web to sell tickets, provide boarding passes, and answer queries about flight arrials and departures, taking pressure off the need to grow call center operators and supervisors as travel bounces back during the high season. Click stream analytics accompanies these transactions and interactions in support of customer service, real time travel promotions, and up selling of seating upgrades as departure nears. This carrier also expects to reduce marketing and sales expenses. Prior to its data warehousing upgrade, a simple customer profile report once required 45 minutes of manual data gathering and assembly. The EDW automated running up to 50 of these reports at once. On average one report completes every two minutes. This report is run over 100 times a week by marketing programs. This is an example of the value-added from the EDW in applications that are not necessarily advanced analytics, but simply good, solid "run your business" reporting. This too pushes the boundaries of business accomplishment and insight forward towards new horizons of customer intimacy, brand development, and cost reduction.

Transportation data warehousing has been engaged in issues ranging from schedule planning to tracking shuttle sales. Passenger information is the foundation for micro revenue as well as the source for bonus payments on travel agency commissions. Micro revenue is a small transaction of a penny (or fraction of a cent) on the dollar as customers click through a banner add and purchase a fare being promoted or as one carrier in a multi-carrier star-like alliance makes a referral to a connecting carrier.

Additional data warehousing functions include determining and optimizing international routes; planning new equipment purchases and selling old ones; monitoring the carrier's marketing partner relationships to optimize value, tracking special marketing programs; evaluating the impact of various products such as electronic ticketing and carrier connections; determining the value of a customer, where are they sitting and what did they pay; advertising based upon point of sale information; planning and evaluating pricing points, gains and losses; commission analysis of travel agencies and the inter-carrier (star-type) alliance. According to the client, the number of queries has increased by about a factor of six over the past period. Concepts like 'shuttle', 'electronic ticketing', and 'airline alliance' were not even heard of when the system was developed and it has played an essential role in testing the concepts, implementing them, and evaluating the results. Marketing feeds the micro revenue database, which was built for sales to plan and track revenue (net of front- and backend commissions for travel agents). Marketing feeds other decision support systems such as the target marketing system. The client reports that such a target marketing system is a first step in the direction of their next generation Customer Information File.

Based upon research into on-line travel and hospitality case histories, a critical success factor is the information captured, analyzed, and exploited by the click stream, dynamic data warehouse. This infrastructure makes it possible to know what customers are buying what products or services and when and where are they doing so. This makes a difference in knowing when to tweak prices to promote a discount and when to hold the line because demand is high or it's a sellers market as the client interacts with the booking web site. However, in spite of success, web-based travel agents know they cannot rest on their laurels. The global travel distribution industry is intensely competitive. Imitation is the highest form of flattery, and numerous imitators – competitors – of the first mover innovators are now in the market.

This research finds evidence that early entrants and innovators are now fighting back by innovating in unstructured content. Instead of being merely a transactional engine for booking travel and hotels, one service provider is using XML and content management capabilities to deliver value-added inspiration to its prospective travelers at the start of the process of booking with data warehousing based cross- and up-sell recommendations. Travel narratives are featured promoting exotic destinations such as Tahiti or a cozy weekend get away at a local bed-and-breakfast near a scenic lake. This contributes to enriching the entire customer experience in using the web site. Thanks to a consistent, unified representation of its clients in a data warehouse, one provider reported to this analyst that it is able to attract and retain travelers through broad promotion and loyalty

programs. The data warehouse is the hub for making significant improvements in services across its brand portfolio including hotels, cars, excursions, and related travel services by sourcing the travel-relevant market basket of services.

The travel-related "market basket" is obviously different from a grocery store, but the concept and underlying logic are similar. In the grocery domain, wine and cheese, chips and dip, and the occasional odd couple such as diapers and beer are on the critical path. In contrast, in the case of on-line reservations, the market basket includes airline tickets, car rentals, hotel accommodations, side trips, and travel accessories such as luggage. The data aggregation and data mining capabilities of data warehousing are and will remain on the critical path to keeping the industry leader out in front and pulling away from the competition. The power of a consistent, unified representation of the product portfolio from the data warehouse is that it enables the client to earn incremental revenue by offering similarly profiled clients the deltas from similar market baskets including promotions designed to make the deal more attractive and complete it.

Experience shows that the time value of pricing is a key to on-line revenue. Well-known brands want to move excess inventory without driving down the value of the brand. Discount providers need an efficient outlet for their products and services. In both cases, analytics delivers the intelligent information integration required to optimize the convergence of price at any given time on a perishable commodity such as an airplane seat or hotel room. Business intelligence analytics enables knowing the value of such merchandise on an automated basis and being are able to optimize the revenue for the suppliers of the products – as well as for the on-line web site. In this sense, the application is similar to yield management; but the analytics are performed across a variety of suppliers and kinds of merchandise.

Thus, the business model for on-line travel services is one that puts a high premium on innovation through information aggregation in the dynamic data warehouse. This includes areas such as its portfolio of travel brands, expanding international and corporate services, innovating on behalf of travelers and supplier partners; exploiting its scale in technology and operations based on data warehousing. The transition to cloud-based service oriented architecture is the next stage in the virtualization of computing resources, enabling flexible response to peaks in seasonable demand.

Recommendations and Findings

As a result of dozens of conversations with clients and customers about how they are using analytics to change the limits of what is possible in business, this research concludes that business intelligence analytics changes business and makes a dramatic difference in using:

- Information instead of expensive inventory to reduce costs through superior demand planning and forecasting in consumer packaged goods and retail

- Advanced applications such as the demand plan, closing the loop back to the operational system, and actually sourcing the forecast such that it is optimized to reduce costs of time and transportation in supply chain operations both up- and downstream directions

- Information-based analytics in healthcare to capture, analyze, measure, and report on key clinical and cost factors, enabling providers and payers to design and implement evidence-based medicine and connecting the dots between high quality medical treatments, favorable healthcare outcomes, and accurate, prompt compensation for services rendered

- Pay-for-performance in healthcare to identify and reduce the cause of variations in care and variations in the price of care, delivering value in as improved quality of care and reduced costs

- Data warehousing based analytics, data mining, and information based-medicine as payers, providers, and administrators roll up their sleeves to work smarter and more cost effectively in improving the quality of care while reducing costs by identifying best practices and consistent implementation across organizational boundaries

- A new and emerging healthcare computing cloud to support secure, cost effective, time saving communication of patient (and business) information between providers, payers, and consumers of healthcare services

- Data warehousing concentrating on the product dimension of master data to deliver cost reductions in supply chain management

- Data warehouses on the customer dimension, emphasizing marketing services, growing incremental revenue through cross selling, up-selling based on life-time value, and market basket analysis

- A consistent unified view of customers, products and services in financial services to see the forest for the trees, providing incremental revenue through cross selling and up selling and eliminating unprofitable customers by sending them to the competition

- Innovations in accounts receivable and collectables to mine needles of gold in the haystacks of unstructured call center texts, telecommunication transactions logs, and healthcare claims adjudication workflows, recovering significant dollars in top line revenue

- One of the "stickiest" relationships in the business – airline frequent flier programs - to correlate just the right offer to the customer with her or his

"moment of value" when the individual is ready to make a purchase, based on a market basket analysis of tickets, rent-a-car, hotel, and excursions

- Yield dynamics around variable pricing of perishable commodities such as seats on airplanes as the clock ticks closer to departure, optimizing revenue by balancing those who can plan ahead and those who cannot

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- A data warehouse of real-time information to make off-setting trades of options-based puts and calls, smoothing the volatility of fuel costs in airline operations and realizing significant fuel savings in spite of market swings

- Web-based analytics in a variety of contexts, including on-line travel, to "know" what the prospective buyer is looking at on the site and what she or he might be thinking just prior to purchase in order to make just the right associated offer of a car rental, excursion, or hotel upgrade

These business intelligence applications, systems, and results have directly changed and are in the process of transforming the limits of what is possible in their enterprises by means of data warehousing, data mining, analysis of unstructured data, clear and concise reporting, and emerging applications in cloud computing. The results are significant and substantial. However, from another perspective they are just the tip of the iceberg and a first look at what is possible in attaining business insight through analytics.

About Lou Agosta, Ph.D. (Alleingang Inc.)

Lou Agosta, Ph.D., independent industry analyst, provides thought leadership and guidance on technology, business, and market trends to information technology (IT) software, service, and hardware supplies in creating and exploiting market opportunities, addressing existing and emerging customer requirements, identifying and targeting prospects, designing marketing messages, building campaigns based on these messages, and implementing them. Lou serves clients with IT industry analysis, research, product positioning and marketing, competitive analysis, analyst relations (AR) support, and custom consulting services.

As an independent industry analyst, Lou Agosta concentrates on data warehousing, data quality, data management, and related business intelligence issues. Lou spent six years as a technology analyst with Giga Information Group and in years prior was a database administrator and large systems data architect. Lou has published frequently in Data Management Review (now Information Management Review). He is a regular contributor to B-Eye-network.com. He has published nearly 100 articles and reviews on data warehousing, business intelligence, and business and IT integration. He specializes in translating information technology into business value. Lou has provided unbiased research, consulting, and business advise to such companies as ABN Amro, Aegon, Allstate, Bank One (Chase), Blue Cross of Illinois, BP, Citadel Group, Boeing, Kraft General Foods, LandsEnd, LexisNexis, 3M, NBC, Nestle/Purina, Northwestern Mutual, RBC, Reuters, Sabre, Sears, Time/Life Books, UBS, and the U.S. Department of the Interior. Lou has also served as an instructor in logic and system design at DePaul, Loyola and Roosevelt Universities in Chicago. Lou's book, *The Essential Guide to Data Warehousing*, is published by Prentice Hall. Lou's Ph.D. is in philosophy, which is always good for a laugh, from the University of Chicago. All the usual disclaimers apply. Lou's Chapter C Corporation, "Alleingang" is the German word for "solo," since Lou is the principal and only employee.